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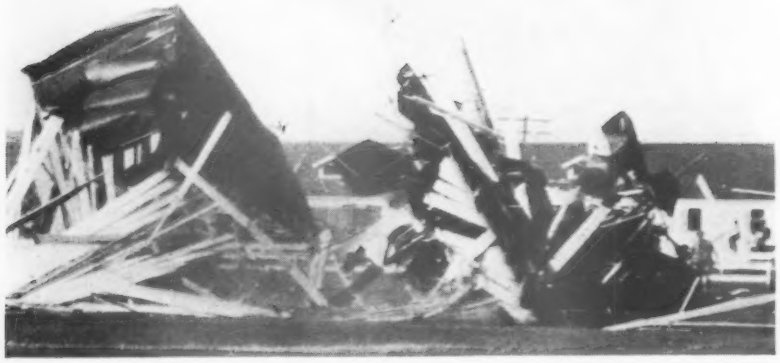
Some Inside Dope on Public



This highly successful crash was made at Great Falls, Mont.

And then the plane broke into flames at Great Falls, Mont.

And he washed out this plane at Memphis, Tenn.

by

CAPT. F. F. FRAKES

America's most daring stunt pilot and plane crasher.

LIFE may begin at forty, as the book says, but flying at forty years of age sure lacks the kick that it had at twenty.

Twenty years ago I would gladly miss a meal just to have the pleasure of looking at an airplane, but in later years when I involuntarily missed my meals, it was not willingly. And I think every Jenny Jerker knows what I mean when I make that remark.

After deliberately and intentionally crashing thirty planes at fairs and for the movies, I'm getting all fed up with the racket because this, as with everything else that is repeated frequently, becomes monotonous and tiresome. No, I'm not getting yellow from any recent mishap nor am I losing flying ability. It is, truthfully, just because I've had enough, and that's that.

This idea of crashing planes at public exhibitions first came at the beginning of the Depression in 1930. It was at this time that exhibition flying of the usual type was dwindling down to nothing, so far as financial returns were concerned, and all of the cow-pasture heroes were casting about for some novelty in the way of flying in order to catch up with the ordinary routine expenses of room and board.

Thereupon, my two partners and myself —two swell fellows and damn good flyers —tried to solve the problem of awakening waning public interest by introducing some new sort of stunt. We argued this way and that and viewed the game from every standpoint. Passenger carrying was out, that was certain, for the public seemed more interested in watching stunt flying

Jean De Luca is now taking lessons in the noble art.

Plane Crashing Exhibitions

Meet Capt. F. F. Frakes and his efficient mascot "Mac."

Halfway through the model house but no one hurt at the Indiana State Fair.

than flying themselves. On the other hand, stunt flying, in its then state, was also limited because nearly everyone in the country had seen acrobatics and had witnessed pseudo dog-fights, in wartime air circuses. We had to have something brand new in the way of a real and novel thriller, if we were to cash in on the job.

After hours of wrangling, we came to the conclusion that the best possible stunt thriller was to crash a plane in full view of the audience. A full size standard ship was to be taken up to a good altitude and then nosed down into a crash ending dive with the plane reduced to kindling wood and fabric patches.

Finally, two of the partners agreed to go ahead and stage the first crash show, while the third member was to stay at the old stand in Nashville and finish the flying time that we had contracted for as the boys didn't have money enough to make cash refunds on the existing contract. This was the beginning of the old time Frakes Flying Circus, started on a shoestring, that traveled from the Gulf to the Great Lakes during all the years of the Depression.

We decided which one was to make the first crack-up exhibition by drawing straws and I, with my usual luck, drew the short straw. I was to be the first one to try out the new deal and if I succeeded then I would try it again. If I lost, then I probably would not be much interested in what happened after that. This sure was a great adventure that the short straw handed to me, and one that had me thinking hard for many days.

But actually, the worst part of the affair was the dread of the Department of Commerce and the attitude that they might take in regard to the crash stunt. One of my partners wrote a fine letter to the superintendent of the Department, pointing out the

This was really a narrow escape at Birmingham, Ala.

From 2,000 feet straight down into the water.

educational value that the stunts would have for the other pilots and the effect that they would have on the public that witnessed the shows.

But, unfortunately, the nice letter had but little weight with the Department and they were down on us, hook, line and sinker. My partners were scared at the fuss made by the Department and finally withdrew from the deal, leaving me to hold the bag. I would be the goat if I did go through with the crash (having to reckon with the Department), or I would be the goat with the public if I didn't go through with it because we had already advertised the stunt extensively and the newspapers had given us much publicity.

If I allowed myself to be scared out by the threats of the Department I would be called yellow by all of my fellow pilots. If I did go ahead, then the Department would have put me in jail. What to do? What to do? Finally, I decided to risk the wrath of the Department and the large wreath of lilies that seemed equally promising at that time so I went ahead and took the chance.

My first crash was witnessed by a large crowd, but I didn't do a great deal of damage to the ship, although fortunately, it looked bad to the laymen. Much was said in official circles and many threats were made, but nothing was done further except that I was "grounded" immediately after the first crash. However, if I couldn't fly I could act as a promoter for the circus and this I continued to do for some time with one foot on the ground. The other fellows carried on the usual circus antics with a few additional special stunts that we had invented. Not much in it, but it kept us rolling until the right time came along.

And then, after this little period of probation on the ground, the ground order was revoked by the Department and I was free to fly once more. Then, surprise of surprises, I was called into the Supervisor's office where he told me that as far as the Department was concerned I could crash all! I liked from that time on and that they would take no further action on my crash exhibitions. And did I break loose then and ride 'em down into the ground!

I wired the Fox Film Company and went into the crashing business in a big way. Except for a little argument with a local inspector who hadn't heard the big news from headquarters, all went well with the Department and myself for over a year. I worked in the pictures and I operated my circus until finally I found that I was listed as a showman rather than an aviator and so I made a different setup with my circus and played the game with the showman's slant added.

This, however, is where I stuck my head into the frying pan. As long as I was a flyer and was rated with the flyers I was not bothered, but as soon as I ignored the flyers then my troubles began. It has been a battle throughout the states with the flyers where they have heard falsely that I was an outlaw, and they jump on me at every opportunity in the roughest and crudest manner. But, after a manner, this is excellent publicity and by their attacks, they are unconsciously increasing my income. Publicity, be it good or bad, is always acceptable in the show business as was pointed out by that ace of showmen—P. T. Barnum.

Once you are considered as a freak by the public, you'll be in demand by the show promoters. In this game you must continue to get freakier and freakier with each passing year or you will be a has-been in quick order. You can't stand still in the show business. You must either keep on moving ahead or you will lose out permanently, and as there seems to be nothing freakier or more unusual than crashing ships in

(*Concluded on page 52*)

Here's a bigger and better crash at Sheridan, Wyo., another narrow escape. Everything on the horizon looks rather shaky.

The three enlargements above, made progressively from a movie film, show the plane at the moment of impact (top), inside the collapsed house (center) and in flames at bottom. This crash was made at Minneapolis, Minn.

Aero Wonders Shown at Paris

by R. C. WOOD

The recent aeronautical show held in Paris, France, displayed a most comprehensive assortment of aircraft produced by all the European nations. As might be expected, warplanes played a prominent part in the show.

A general view of the magnificent 15th International Paris Aero Show at the Grand Palais. Ships from all nations were displayed.

THE 15th International Paris Aero Show, held at the Grand Palais, which closed its doors on Sunday November 29th last, after a duration of 17 days, contained many interesting features.

Military machines of the low or mid-fuselage cantilever wing type, equipped with retractable landing carriages were largely predominant and covered about all the ground floor space of the Grand Palais.

Several interesting types of tourist and light planes were also exhibited in the side ground floor galleries but except for models and photos, no seaplanes were shown.

The construction and equipment of many of these military planes represented the latest types in design with especial attention being given to streamlining all the various parts. The fuselages were mostly of monocoque and semi-monocoque construction covered with a stress carrying skin of smooth duralumin sheet, flush riveted.

The shapes of the various parts were well curved in cross section and free from buckles. The wings were likewise constructed of duralumin throughout although in some of them steel longerons were used. Channel sections were largely used in the construction of wings and fuselage and all the machines had either split or trailing edge flaps.

The engines also showed a marked increase in power and efficiency over those exhibited in the 1934 Paris show.

Two large transport planes mounted in the main aisles attracted especial attention. One could not fail to be impressed on entering the Grand Palais with the enormous Farman, all metallic, 40 passenger strut braced sesquiplane, equipped with 4 Gnome & Rhone doublerow radial air cooled engines K14 type, of 810 HP. each, thus making a total of 3240 HP.

Two of these engines are mounted in tandem on each side of the fuselage on nacelles supported by the stub wings. The span of the upper wing is 117 feet (36 meters) and the fuselage is 75 ft. 9 ins. in length.

The cabin is over 45 ft. long by 6 ft. 6 in. in height and can comfortably accommodate 40 passengers. The undercarriage is retractable. The plane weighs 18 tons and carries a useful load of 6 tons with a flight radius of about 950 miles. It has a maximum speed of about 190 mphr. with a critical altitude of 2,000 meters (6,500 feet) and a ceiling of 7,000 meters. A crew of 4 men is carried in addition to the passengers.

This plane was typically a Farman production in that it displayed an entire lack of attention to the present fad of eliminating parasitic resistance. There were enough external struts in the landing gear to make a second biplane.

It is expected that this plane will shortly be put in service on the Paris-London and Paris-Marseilles routes of the Air France Co. As if to accentuate the dimensions of this transport plane a diminutive Farman single seater sport plane of the type termed "Mousquito" was placed on each side of it. These "Mousquito" machines have a span of 26 feet; a wing surface of 110 sq. ft. and are equipped with Ava 25 HP. engines. More information regarding interesting details of the exhibits will be given in the next issue.

XUM

Dope on the Heath Lightplane

THIS article is written for the benefit of owners of Heath Parasols and those who are building their own Heath planes.

The Heath Parasol is probably the most popular, yet least understood, lightplane in America. For one thing, we hear quite often of these little planes being built by amateurs and that they either fail to fly at all or cannot gain enough altitude to make them practical. On the other hand, more Heath Parasols have been built by amateurs in this country than all other types of lightplanes together and a greater percentage of them have been successful.

I have test flown a number of home-built Heaths, some that performed very well and others not so good. Let us look into the cause of failures, first in the airplane. Wherever a home-builder has followed the plans and instructions reasonably in building a Heath I have always found that he has a safe, well-performing lightplane.

Those that don't fly are usually those constructed by persons who are careless or wish to change the design and add a few features of their own, and usually a lot of weight.

Inferior materials also cause failure and often endanger the pilot's life if the plane does get off the ground. Suffice to say, that if properly constructed and powered with a good engine a Heath Parasol will fly and fly well.

As to the power-plant, this is probably the usual cause of failure of home built planes. To fly properly, the Heath Parasol must be equipped with a good converted Henderson, a Heath Henderson or Heath B4 engine, turning a 4½ ft. x 27" pitch propeller 2600 r.p.m. is better. Don't attempt flying with a worn out motor-cycle engine swinging a doubtful prop about 2300 or 2400 r.p.m. It just ain't bein' done.

I've flown many Heath planes ranging from the original Super Parasol type on up the line to the latest LN Parasols and Continental powered Centerwings and will say that for home-building and amateur flyers, their design and construction is ideal. Fifty cent per hour operating cost is attractive for private flyers, too.

A few timely hints to the home builder will undoubtedly save him a lot of time and money. If you live in a high altitude or are forced to fly from a small field, build your Model V Parasol with a long-wing (31').

Be sure to equip your Henderson or B4 with an air-scoop to deflect air over the rear cylinders. Overheating is probably the most frequent cause of failure in these little engines. Spark plugs are also a very important item. Use a good mica plug. I have never found a porcelain plug that will not heat up and misfire after several minutes flying.

I had the misfortune of having a complete set of porcelain spark plugs cut out at once on the engine of a home-built midwing that I was test-hopping and I had to slip into a very small field. Luckily there

(*Concluded on page* 54)

Armstrong-Whitworth Bomber

Three-quarter front view of the new Armstrong-Whitworth bomber that greatly resembles a transport plane in its general lines.

THE fact that Great Britain is now equipping its air force with many new aircraft is undoubtedly known to all of our readers by this time, because of the great amount of publicity given to this program of putting new planes in service.

Furthermore, Britain is following in the steps of other large powers by now favoring low-wing planes, a type considered taboo in English military aviation until just a short time ago. As the biplane stepped out, one of the ships that has taken its place, and which is now being supplied in large numbers, is the Armstrong-Whitworth "Whitley" heavy bomber.

The Whitley is a midwing, full cantilever monoplane specially designed for long range high speed bombing and powered with two radial engines. The design of the ship is very clean and all bombs are carried within the structure of the plane, where they are not in the slipstream to cause unnecessary drag and consequently lower top speed.

Wing structure consists of a single box spar of corrugated alloy sheet. Although very thick in section at the fuselage, the wing tapers in both chord and thickness. Landing flaps are of the split trailing edge type; they are hydraulically operated and extend over a large portion of the span.

A similar type of construction is employed in the tail surfaces, which are adjustable on the ground. Tabs are also supplied to be used for trimming while in flight. The stabilizer is mounted at the very bottom of the fuselage, and twin fins and rudders extend upward from this at about half the distance from the fuselage to the outside tip of the stabilizer. A strut of very small size runs horizontally and connects the top of the fuselage with the fin at about its middle.

The engines used to power the Whitley develop 795 h.p. each and are of the Tiger IX type, produced by Armstrong-Siddeley, a subsidiary which turns out these powerplants for both the parent organization and other manufacturers. The nacelles in which the engines are housed are rather long, the main portion being under the wing to serve as the well for the landing gear in its retracted position. Full cowls are used around the engines and it is interesting to note that controllable pitch Hamilton Standard metal propellers are standard equipment. The engines are geared and supercharged and are mounted on rubber pads and the engine mount extends back to the main wing spar.

The undercarriage referred to just a moment ago is of a very sturdy type with an oleo shock absorber supplemented by steel springs on each side of the short axle, which is just long enough to permit the wheel to turn freely between the two struts.

In retraction, the movement of this entire unit is upward and slightly to the front. Hinged metal side plates completely close most of the opening, but a portion just large enough for the wheel to protrude slightly is provided. This allows the plane to make a landing even if the mechanism should stick in the "up" position. The tail wheel is capable of swivelling in any direction.

A light alloy is used in the construction of the full monocoque fuselage, which is built in three sections and flush riveted with a smooth metal skin. The cross section of the fuselage is rather large because of the bombs and crew carried, and its general shape resembles an oval.

The pilot and co-pilot ride in an enclosed cabin on the top of the fuselage and slightly forward of the leading edge of the wing. A radio operator is carried in the middle of the plane. Two gunners protect the ship from practically any angle.

An Armstrong-Whitworth balanced gun turret is provided in the very nose of the ship and is of a patented type with transparent cupola. With its use, the gunner is fully protected from the airstream and has almost effortless operation, as the weight of the machine gun is balanced by the weight of the gunner. Furthermore, the balancing effect of the air on the gun barrel adds to the ease of operation.

Another gunner in the rearmost portion of the fuselage is likewise armed. Besides his gunnery duties, the man in the nose must take care of the bomb dropping, and a number of small transparent panels are provided to give excellent forward and downward vision.

Although no weights or performance figures are available at this time, we can tell you that the wing span of the Whitley is 84 feet. The length is 69 feet, 3 inches; height is 12 feet, 9 inches.

This plane is undoubtedly one of the leaders in the present European bomber competition in every feature of a modern egg-layer. It has climb, speed and carrying capacity.

XUM

Memories of Lincoln Beachey

by MAX KARANT
(Data from Art Mix's diary)

Arthur H. Mix, Beachey's former mechanic, works and lives in Buffalo, New York, today. The Mix diary brings to light many gems of human interest about America's first and perhaps greatest stunt flyer.

THAT Lincoln Beachey was the greatest airman of his time is not only the contention of laymen who happened to see him perform at a few carnivals, but also the fond belief and memory of Arthur H. Mix, Beachey's mechanic in aviation's halcyon days of breath-taking glory.

Although approximately 17,000,000 people saw Beachey fly before his death in March, 1915, few knew the almost legendary airman as well as Arthur Mix. Mix, after obtaining permission from the commanding officer of the naval aviation school at San Diego, where he was enrolled at the time, to travel with Beachey on the latter's exhibition tours, journeyed more than 80,000 miles with the famed airman before the fateful day when Beachey dived to his death in San Francisco Bay.

Arthur Mix lives in Buffalo, N. Y., today. He works in the engine assembly plant of the Curtiss Aeroplane and Motor Company, watches the continual advancement of aeronautical engineering and ponders on the things he and Beachey went through in those days when an airplane was little more than a flying chicken coop.

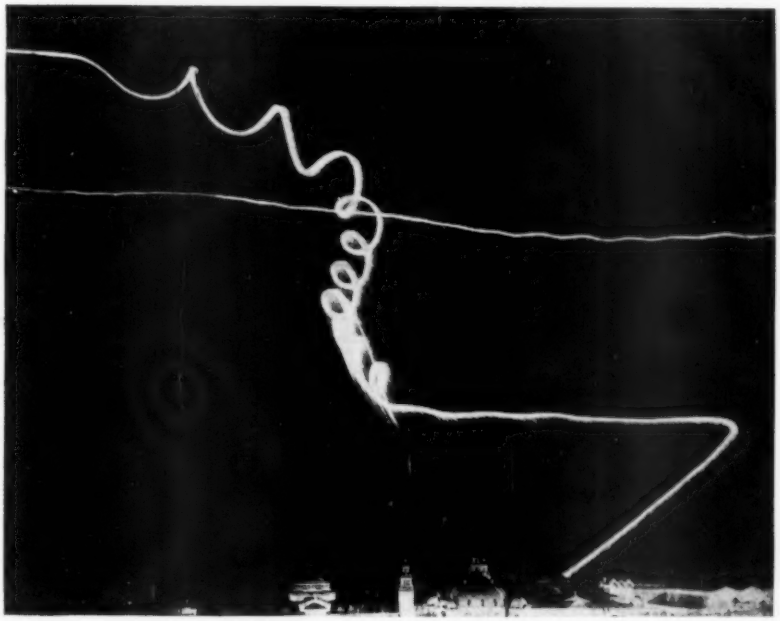
Though diaries may be a jinx in Hollywood, to Art Mix (now 51 years old) his diary is invaluable. For in that yellowed book the faded handwriting of a hard-working airplane mechanic of pre-war days tells many sparkling stories of aviation's adolescence. Hurried notations, scribbled perhaps aboard a rattling all-night milk train en route to the next stunt show with Beachey, tell of flying incidents that would make a modern airline pilot wince in fear.

But that doesn't necessarily mean that Lincoln Beachey was just a careless, crack-brained pilot who had more nerve than brains. Mix's diary tells many tales of Beachey's care and thoroughness. Above all, though, Lincoln Beachey was as skilled and light-touched an airman as has ever held a control stick before, then or since. An entry in the Mix diary gives an example of this:

"(Beachey) raced many times with Barney Oldfield around ½ and one mile tracks . . . both doing 90 miles an hour. He had such wonderful control over his plane that he would tap Oldfield on the head gently with the front wheel of the plane . . ."

Arthur Mix knew Beachey not as a daredevil, hair-brained pilot, but as a far-sighted airman far ahead of the then-current trends of aeronautical engineering. What other pilots feared to do, Beachey always was prepared for. Tests with unfamiliar equipment and with new ideas always appealed to Beachey. Mix's diary also proves this:

"At the army field, College Park, Maryland, in August, 1912, Corporal Rice and I (Mix) put up four flags 600 feet apart which made a square 600 feet each way.



A flare on the wing of Beachey's plane and a time exposure got this result at the Panama Pacific Exposition in 1914.

Warren Eaton, Lincoln Beachey and Art Mix.

. . Beachey had us remove the rudder from our Army No. 2 Curtiss plane, then he took off. . . . He made three figure-eights and landed without getting out of the (square marked off by the) flags. . . . He used his ailerons and elevators only in making the turns. . . . That was done to show the Wright brothers' patent attorneys what could be done with that type of plane. . . .

"We then installed the rudder and he spiraled the flagpole, keeping the aileron of the plane within three feet of the pole all the time. . . ."

Things like that would cost an airman his license today. But, in the days of Beachey no one knew whether such things were possible and few fliers—if any—ever wanted to try to find them out. But that exhibition of grass-cutting caused the brass hats to quake in their boots for, although they had the information they sought, Beachey had come uncomfortably close to wiping out the United States Army air force. So, Beachey was "penalized" by being forbidden to fly army airplanes at College Park after that.

Though Lincoln Beachey was a daring practicing aeronautical engineer at heart, he also was the daring stunt pilot capable of things that have made Al Williams, Frank Clarke and Ernst Udet internationally famous. But Beachey's stunts, daring as they were, were made with planes that at least doubled the hazard with their flimsiness. Nevertheless, he went through with things that are almost impossible to believe. Again we refer to Mix's diary:

"At . . . an amusement park near Cincinnati in the summer of 1914 Beachey told me he thought he would ride the roller coaster some time . . . so at three o'clock his time came to make a flight and away he

XUM

went . . . but he kept flying in circles at about 600 feet. . . . All of a sudden he spied a car loaded with merrymakers on the roller coaster coming up to the top and down he came right over the car . . . flying gracefully; he took all the turns and dips and, believe it or not, he took the hairpin turn right along with the car. . . . The kids in the car couldn't take it . . . water was applied to the girls' foreheads but they later forgave him and got his autographed photos. . . ."

Crazy as that roller coaster episode might seem, his mechanic's diary tells even more scary tales. Few people know of Beachey's daring flight *inside* the machinery hall at the Panama Pacific Exposition in San Francisco in 1914. It probably was one of the wildest airplane flights ever made in the history of aviation. Let Arthur Mix tell it:

"There was a 10 by 10 inch post every 50 feet and each was 76 feet high. . . . The hall was filled with . . . thousands of sacks of plaster and piles of lumber. . . . A small runway had been cleared just enough for the plane to get through. . . . Beachey told me the flight was to be made for the movies. . . . The movies showed that he flew inside and a nice landing was made—up against the south wall. . . . But nobody was hurt and the plane was ready to go on Sunday (that was on a Thursday). . . ."

Arthur Mix has seen many a crack airman since Beachey's days, but his sentiments in the matter always have been and probably always will be those he expresses today:

"I just would like to take a delegation of our present-day pilots to the places where Beachey flew from and landed. . . . I'll bet they would come home with their hair turned snow-white even without trying to fly out of those places with today's vastly superior equipment. . . ."

Little has ever been written about Lincoln Beachey's early life, the days before he became a much-sought addition to the heart-stopping departments of the home town carnivals. Arthur Mix has carefully chronicled some hitherto unknown facts about Lincoln Beachey's early days.

Lincoln Beachey was born near Golden Gate Park, San Francisco, in September, 1887. When he was killed suddenly on a flight over San Francisco Bay in 1915, Beachey was 28 years old.

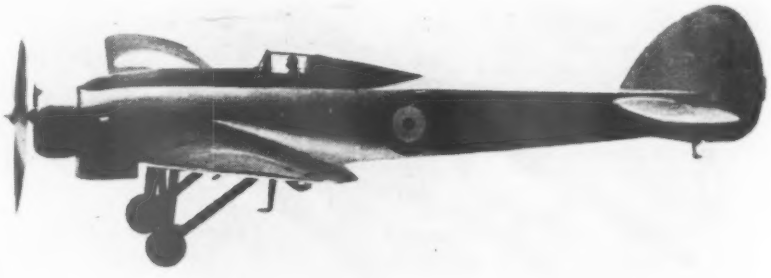
He was the son of a Civil War veteran and went to school in San Francisco. As a boy, Lincoln had a newspaper route and sold extra copies on the streets after delivering his route. When he reached his 16th birthday, Beachey's mother bought him a bicycle which he proceeded to learn to ride with such proficiency that before long he was appearing in a vaudeville trick bicycle act. With his instructor, F. E. Carral, Beachey learned to ride so ably that Mix believes this ability later proved invaluable to Beachey the airman. As an airplane pilot, Beachey tried every difficult maneuver he ever had gone through on the stage with his bicycle.

In 1905 Beachey met and soon after flew small dirigible balloons for Baldwin and Stroble at expositions and fairs. It was in the latter part of 1910 when, in Los Angeles, Beachey flew his first airplane under

(*Concluded on page* 58)

AVIATION'S LATEST

Your garage will accommodate this latest Kinner model.



World altitude record now belongs to this British Bristol monoplane.

Britain's fleet of new airliners includes this B. A. Double Eagle.

This Fairey "Battle" is designed to do just that for England.

Backstage at Wright Field

by JAMES FARBER

Wright Field, material and experimental headquarters for the Army Air Corps, always has been the Mecca of seekers-after-information concerning the absolute latest developments in world aeronautics.

A SURVEY and detailed study of the Air Corps Materiel Division, Wright Field, Dayton, Ohio, is far more than simply a Cook's tour of a highly interesting center of aeronautics.

To the discerning reader of POPULAR AVIATION your correspondent hopes to present such a picture of the activities at this all-important air base that he will be able to decide in a highly intelligent way, for himself, just what opportunities lie in aviation today aside from that of actually piloting an airplane.

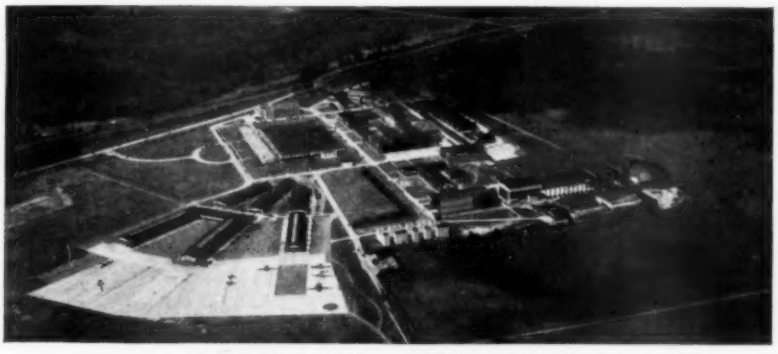
There is a military maxim that there must be two men behind the lines for every fighter in the front lines of the zone of operations. Likewise, it has been a development in aviation that something of the same proportion exists between the number of pilots and those who never leave the ground.

Before an airplane can be turned over to its helmeted pilot, bright props whirling, engine tuned, everything ready for a roaring trip through the limitless skies, there have been scores of men at work: engineers, designers, clerks, mechanics, and shopworkers. Even in faraway Spain, where weight-saving balsa wood is carefully cut for use in aircraft, there are those who must properly be considered part of the vast number of persons employed in the interests of aviation.

Success in the air is a matter of engineering plus the human equation. As our engineering improves things, takes advantage of every conceivable factor in the improvement of aircraft, the human equation is left less to chance.

First of all, let us answer the question: "What is the Materiel Division?"

The word "materiel" (note the "e" in "el") applies to every object, bit of raw material, from a complete flying field to the smallest bolt fastening a strut and from the complete airplane itself to a high altitude flying suit. It is the specified function of the Materiel Division, at Wright Field, to have in readiness for immediate production and service the most advanced types of aircraft, engines, armament and other aerial defense equipment.



Wright Field at Dayton, Ohio, from the air.

Brigadier General A. W. Robins.

In brief, then, it will be seen that there are obvious opportunities in this tremendous work for him who knows what is going on and can decide his qualifications.

In general, the function of the Materiel Division is engineering.

At the Field, the Engineering Section is composed of five main branches: Aircraft, Power Plant, Equipment, Materials, and Armament.

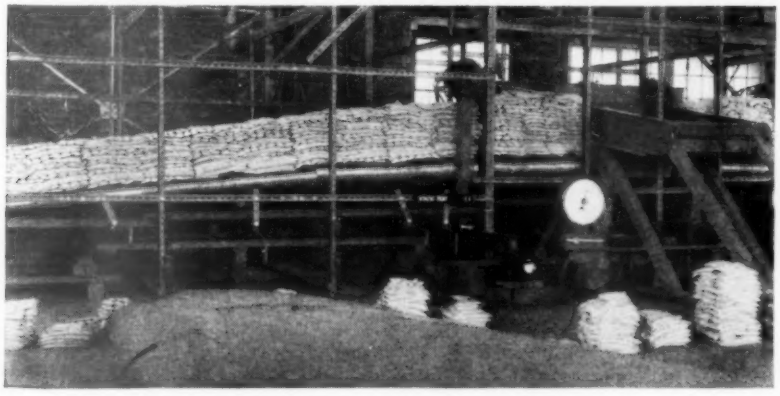
The Aircraft Branch deals primarily with developing new types of airplanes and airships, together with improving those already in service. All designs of new ships are passed on by this Branch. On the other hand, this group also draws up specifications and qualifications sought and submits them to manufacturers.

The Wind Tunnel laboratory of this Branch contains two wind tunnels, one 14 inches and the other five feet in diameter. The first is used to test small airfoils and propellers; the latter to test complete airplane models. A draft of air is forced through the tunnel in each case, and, in passing through at a definite rate of speed, has the same effect on the lifting surfaces as though the real ship were moving at that rate of speed through the air.

The importance of the tunnel lies in the fact that it costs only one one-hundredth as much to make a change in design on a model as it does on the full-size plane or foil.

Under the Aircraft Branch is also the static (weight) and dynamic (impact) testing labs where the structural strength of planes is determined. The Propeller Unit is concerned with the design and test of Air Corps props and is equipped with the largest test rig in the world. Props 45 feet high may be tested with it.

One stand can whirl a propeller 4300



All-metal airplane wing undergoing static load test.

XUM

r.p.m. One of the operating motors develops 6,000 h.p. Design weaknesses can be eliminated before ever a propeller is attached to an airplane. Virtually all Navy prop testing is done at Wright Field. Landing-gears are also tested as part of the Aircraft Branch's work.

Actual construction of all the Army's lighter-than-air craft is done at recognized industrial plants; the testing is performed at Scott or Langley Field; but the design and engineering is accomplished or supervised by Air Corps men from Wright Field.

The Power Plant Branch includes the dynamometer laboratory which computes and measures all forces developed in high speed motors. Oil and fuel consumption, revolutions counters, engine speeds, and all kinds and types of gauges are studied. Liquid- and air-cooled engines are tested on special stands. A fuel test laboratory, of especial interest to those with a bent toward chemistry, has developed what are probably the highest quality fuels and lubricants in the world.

Many readers are particularly interested in the innumerable devices employed in connection with aeronautics. The multiplicity and variety of projects constantly under consideration and already developed are of tremendous interest to many.

Among these, included at Wright in the Equipment Branch, are the developments in aerial photography, most important contributions of which have been in mapping and surveying. An airplane equipped with a camera can now map a Geological Survey Quadrangle in a few hours, whereas formerly it took several seasons to do the same work accurately. Army men can now develop their prints before they land their planes.

Then, the photographic section of the Equipment Branch has developed mechanism for taking pictures through haze and fog. They heat their cameras by electricity when flying high and have developed the five-lens camera which photographs a 200-square-mile area at 20,000 feet.

Other projects in the Branch include: improved lighting for landing fields; engine

(*Continued on page* 54)

World's largest propeller tester.

THE CONSOLIDATED PB-2A

(See front cover)

Uncle Sam's latest addition to his aerial war fleet. The single seat version of the PB-2A.

LATEST battle-plane to be assigned to the Army Air Corps is the Consolidated PB-2A shown above and below. The particular ship shown in the above photographs is not, as the model letters designate it, a two-place pursuit plane. This photograph was made of the one PB-2A that the War Department ordered built as a single-seater. All the remainder of these ships, however, will be two-place as below.

The pair of PB-2A's shown on the front cover bear the insignia of the First Pursuit group at Selfridge field, Mt. Clemens, Mich. These particular ships have been assigned to the 27th and 94th pursuit squadrons at that army base. These squadrons are members of the First Pursuit group. This new equipment will replace Boeing and Curtiss biplane fighters now being flown by those squadrons.

Consolidated's latest 2-place PB-2A fighter awaits flying orders.

Slips in the Slipstream

AS an ardent fisherman, Alexander P. de Seversky realized that the most helpless man in aviation is a pilot trying to beach or anchor a seaplane alone. So he invented an automatic anchor.

When he dropped down on a secluded lake in the amphibian in which he established a world speed record of 230 miles an hour, Seversky found himself at the mercy of the slightest wind or current, and the whirling propeller prevented his getting to the nose of the pontoons to drop anchor or tie up. Even the largest seaplanes are delicately susceptible to a slight breeze or water movement, so that the pilot usually has to keep his propeller turning to maintain his position.

Seversky's new anchor in its retracted position becomes the rubber or leather-covered bumper on the nose of the pon-

(*Concluded on page* 67)

The Gordon-Bennett Racers

by ROBERT H. RANKIN

First of all the great aviation cup races, and in its time equal in importance to the Thompson or Bendix Trophy races, the Gordon-Bennett Cup races aroused great public interest as a sporting event, but did little to the advancement of aviation.

ALTHOUGH there is very serious doubt as to the real value of air races, it is true that such events usually do capture the imagination of the public.

This was particularly true in the early days of flying when a race was held just about every time two or more planes happened to be in the same locality. Of course we have had through the years such well known contests as the Schneider Trophy Race, the Curtiss Marine Trophy Race, the Pulitzer Cup Race, the Mitchell Trophy Race, and that rather doubtful affair known as the National Air Races.

However, the one race which thrilled folks in the early days and which is still remembered by many was the Gordon Bennett Race for the International Aviation Cup. This, incidentally, was the first international heavier-than-air contest.

During the closing months of 1908, James Gordon Bennett, who sponsored the international balloon races bearing his name, conceived the idea of an international competition for airplanes and he announced, after consulting French aviation experts, that he would give a cup valued at some $2,500 and a cash prize of 10,000 francs to the winner of the competition.

The details of the race were placed in the hands of the Aero Club of France and it was announced that all awards should be made through that group. It was decided that the contests should be held under the rules of the Federation Aeronautique Internationale and that the race should be continued from year to year until one nation should win the cup for three successive years. It was agreed that detailed specifications should vary from year to year as progress was made in aviation science.

The first race was held in 1909 at Rheims, France. Although there were seven craft entered, the race proved to be a two-man affair between Louis Bleriot, of English Channel fame, and Glenn Curtiss, the American pioneer. Curtiss won the affair by the very narrow margin of six seconds. His time for the twenty-kilometer course was 46.5 m.p.h.

He flew a Curtiss pusher powered with a 50 h.p. water-cooled kicker. It had a wing spread of 26 feet and a chord of 4.5 feet. The craft had an "elevator-rudder" which consisted of two small planes set in front of the wings on outriggers.

The rudder proper and the horizontal stabilizers were mounted out to the rear in the accepted manner of that period. Bleriot flew a conventional Bleriot monoplane powered with an 80 h.p. rotary engine. Among the other craft entered in the race were a Wright pusher and an Antoinette monoplane.

In 1910 the race was held at Belmont Park on Long Island and from the great number and variety of craft entered it was a great success. Curtiss, always known as a sane designer, apparently had a brain storm just before this contest for he built a most odd looking racing job. This ship, which was known as the Curtiss Special Speed Plane, was like the standard Curtiss pusher as far as the landing gear and motor mount were concerned.

Around the pylons in the 1912 Gordon-Bennett Races held at Chicago, Ill. This is a composite view made from two photos taken by J. B. Rathbun who served as committeeman at these races.

But, instead of having conventional biplane wings, the design featured a single wing sprouting out from the motor mount. Fixed up above it was a short narrow stubby wing. In general the craft looked very much like a pusher which had shed about three-fourths of its top wing. The craft was powered with an 8-cylinder Christie water-cooled engine.

The hopes of America were tied up in a Baby Wright Racer. This craft was a small edition of the regular Wright pusher. Mounted on a four-wheel landing gear it was powered with a 60 h.p. water-cooled V-type engine which turned twin props. The craft had a span of 20 feet and it was rated at around 70 m.p.h.

In this edition of the races France was represented by five Bleriots, two Demoiselles, and a 100 h.p. Antoinette. This last ship was flown by that gallant Frenchman, Herbert Lathan. The famous English pilot Claude Grahame-White brought over a Farman biplane and a Bleriot monoplane to fly for his country. England was also represented by another Bleriot and a Wright.

In addition to the special Curtiss and the Wright racer there were entered the following planes for the United States: three Wrights, five Curtiss pushers, two Bleriots, a Farman, and an Antoinette. Piloting the Curtiss ships were such well known American pilots as Baldwin, Willard, Harkness, McCurdy, and Ely.

Grahame-White washed out his Farman just before the Gordon Bennett event, but he flew his Bleriot to first place at a speed of 61 m.p.h. His craft was powered with two 7-cylinder engines coupled together. This 14-cylinder arrangement produced around 100 h.p.

The next year, 1911, the race was held at Isle of Sheppy, Eastchurch, England, and according to all of the advance information put out by the publicity directors it looked like France would walk off with the race. However, the event was won by the well known American pilot C. T. Weyman. Weyman flew a well streamlined Nieuport monoplane and his speed for the race was 78.1 m.p.h. His ship was powered with a 70 h.p. Gnome engine.

Among the other craft entered this year were a Baby Wright Racer, a Bristol monoplane, a Bleriot, a Deperdussin, and a Morane. England was represented in the event by such pilots as Alec G. Hancel and O. C. Morrison.

The 1912 Gordon Bennett contest was held at Clearing, Illinois, and it turned out to be an all-French affair. The only planes entered were a 140 h.p. Deperdussin, a 100 h.p. Hanriot, and a 100 h.p. Deperdussin. These craft were all monoplanes. A Burgess monoplane sporting a 140 h.p. Gnome

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was built especially to represent the United States but it never entered the contest. Jules Vedrines flew the 140 h.p. Deperdussin along at 105 m.p.h. to win first place.

The winning Deperdussin was 21 feet long and had a span of 19½ feet. The rounded fuselage was rather well streamlined and the craft was powered with a 14-cylinder power plant.

The following year of 1913 also turned out to be a field day for the French. M. Prevost clipped along in his 200 h.p. Deperdussin monoplane at a speed of 126 m.p.h. to score a very easy first place. His ship was powered with a Gnome and a spinner or pot was fitted to the propeller. Wire bracing was reduced to a minimum and all in all the craft was well streamlined.

Outstanding among the other French planes were a 160 h.p. Ponnier monoplane and a high-wing Morane-Saulnier. The Morane-Saulnier was piloted by Garros who was to gain great fame during the Great War.

With the outbreak of hostilities in 1914 a halt was called to the holding of the Gordon Bennett contests. The races were not resumed until 1920.

With the announcement of the 1920 contest there was decidedly marked activity on the part of France, England, and the United States. The French were determined to win for a third consecutive time and thus claim permanent possession of the trophy. The United States went to rather great lengths to produce a prize-winner, but England was more conservative.

The Gordon Bennett entries from the United States were particularly interesting. This country entered a Curtiss job, a Verville-Packard, and a Dayton-Wright. Each of these planes was built about a motor which had been designed especially for the contest.

The Curtiss craft was a monoplane powered with a special 12-cylinder 400 h.p. Curtiss water-cooled engine. The radiators were streamlined into the sides of the fuselage. The thick monoplane wing was strengthened on either side of the fuselage by a single brace which was attached to the axle of the landing gear. This ship was fitted with a rather broad bladed propeller and the pilot was seated more than two-thirds of the distance to the rear of the fuselage. Roland Rohlfs, famous Curtiss pilot was selected to fly the craft and he pushed it along at 223 m.p.h. on its test flight.

The Verville-Packard was entered by the United States Army Air Service. It was powered with a 500 h.p. water-cooled Packard engine which had a total displacement of over 2000 cubic inches and weighed around 1.94 pounds per h.p. This plane was designed for regular production for the Army and it was developed by the engineers of the Office of the Chief of the Air Service, Engineering Division, McCook Field, Dayton. It was a biplane type with a single supporting strut on either side. Capt. Rudolph Schroeder, holder of the world's altitude record at the time, was selected as the pilot for the race.

The Dayton-Wright R-B was a monoplane design. It was one of the first planes

(*Concluded on page 62*)

Notes on the Design of Lightplanes

The lightplane, of which this is a type, requires careful detail design.

ALL that good design of lightplane fittings requires is a view to the loads which are imposed upon them.

The factor of safety is the starting point. Most lightplanes have a safety factor of from 6 to 10. This means the plane in its weakest part is 6 to 10 times as strong as the worst possible flight loads can impose on it.

For instance, if we know that the normal load on a fitting is 100 lbs. and a safety factor of ten is employed the breaking point of this fitting should not be less than—100x10 = 1000 lbs.

The important point in all airplane construction is the question of what is sometimes called "follow through." It implies that a fitting, spar or strut is so designed that the loads are concentrated on the neutral axis of the part the load is acting upon. In other words there

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Heroic Work by Canadian Pilots

FOR a different sort of ingenuity let us examine the case of Ted Stull, Canadian Airways pilot at Ilford, on the Hudson's Bay Railway.

Three men, engaged in metering the waters of Island River, were working on a raft drawn up on rotten ice just broke suddenly and swept the raft down toward the boiling waters of the fast running rapids.

As the roar of the falls grew louder and the speed of the raft increased the men aboard gave themselves up for lost. They knew that once they were flung into those freezing waters they would be paralyzed by cold in a few moments. The current was strong and they could above the Kenechuan Rapids. The ice never hope to escape. Suddenly the raft was hurled against a rock in mid-channel, swerved, thrown off again and eddied to a stop against another rock, larger than the first. Without waiting to reason why, the three men scrambled out on the rock which lay just out of reach of the shore.

As they crouched in questionable safety the spuming water covered them with spray that froze as soon as it touched them. In that sub-zero weather they were in a desperate predicament for they were effectively cut off from shore; in wet clothing and without food or matches, with which to start a fire.

Furthermore, they had little hope of passersby rescuing them for the nearest human habitation was many miles away. Numbed by the hopelessness of their position they crouched together hoping against hope that help of some sort would arrive.

For more than twenty hours they huddled there in that freezing cold. Jets of spray showered them and the roar of the falls deafened them. They had almost given up hope when suddenly they caught the vibrant drone of a large airplane motor. It was pilot Ted Stull coming to pick them up at their camp—but they weren't at their camp. Would Stull sense something wrong and come to seek them, or would he call back again at another date?

When Stull landed at the camp he saw the beds of the metering party had not been slept in. A veteran of the north, Stull knew something was wrong. Men in this country never failed to keep appointments like this—unless something happened to them. Stull knew that somewhere in those woods he would find the men he had come to pick up—and they would be in trouble. He set off to find them.

Following their trail he was astonished to find them perched out on the rock in mid-channel. They were in desperate need of clothing and warmth but for the present Stull was powerless to aid them. They were too far out to essay a jump and the inervening water was too deep and fast to attempt a rescue by those methods. There was only one way left and that was — to build a bridge to the marooned men.

To build a bridge, however, required tools and considerable strength but Still was not to be outdone by such simple obstacles as those. Rushing back to his plane he brought an axe and rope

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Two-Row Radial Engines

Now the "latest development" in aeronautical engines, the twin-row aircraft motors are not new in the strictest sense. However, these latest gas-eating giants are phenomenal brutes.

THE limitations of the single-row radial engine and the advantages of the two-row type are not new discoveries.

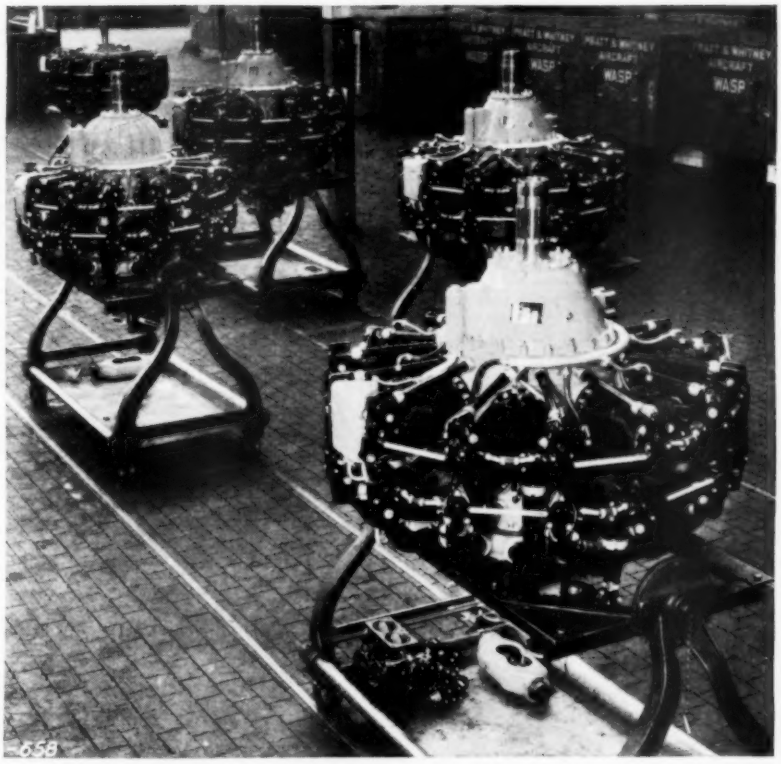
In fact, some of the earliest fixed radial engines were made in the two-row form for many of the same reasons which justify that type today. However, in the horsepower ratings then current, the inherent limitations of the single-row engine were not important; hence, the double-row type has made its most rapid progress only in recent years when increasing engine powers made a change in type imperative.

The defects of the single-row engine for large power output arise from three general causes: (a) the limited number of cylinders, (b) the limited operating speed, and (c) the overall diameter.

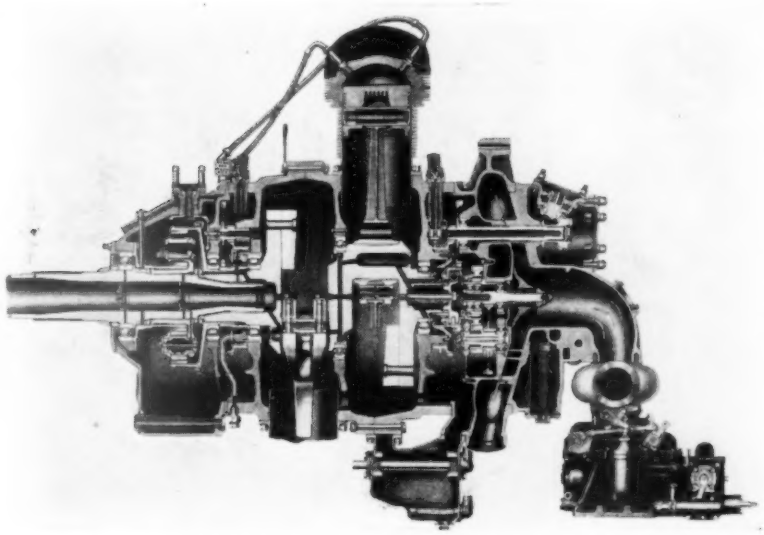
The first cause, limited number of cylinders, effects engine smoothness and stresses because of the torque variation resulting from firing impulses. It is mechanically impractical to use more than nine cylinders on a single-row engine. Hence, with constant crankshaft speed, the severity of torque impulses increases directly with horsepower.

The increase in torque impulse produces a corresponding increase in the vibration of the engine, increases the stresses in both the engine and aircraft structure and also tends to produce distinctive vibration in the airplane.

The alternative, of course, is increased engine speed. If it were possible to increase the power of an engine by simply increasing its crankshaft speed, the severity of torque impulses could be held constant or reduced, their frequency increased and many of the two-row objectives could be attained in the single-row engine.



Pairs of these 1,000 H.P. jobs now fly the airlines. This view was taken in the shipping department where the engines, after testing, are placed in their crates.



What the heart of a twin-row Wasp looks like.

However, the bore and stroke required for the necessary single-row engine displacement produce inertia and explosion loads which establish a rather low safe limit for crankshaft speeds. By contrast, therefore, the two-row engine gains in smoothness not only in proportion to its number of cylinders, but also in proportion to its higher permissible operating speed.

The arrangement of cylinders in the single-row radial engine is advantageous from the point of view of minimum weight and engine length, but it clearly is not desirable in its effect on engine diameter and its consequent effect on airplane performance or vision. It is highly important that engine diameter be kept as small as possible. That the two-row engine of equal output will permit reduction in cowling diameter of approximately 20 per cent is a powerful argument in its favor.

Some seven years ago these tendencies became apparent to the engineers of Pratt & Whitney Aircraft and the two-row development program was started. The first results of that program, the now famous

Twin Wasp and Twin Wasp Junior engines, were put into regular production in 1934 and have, therefore, seen sufficient service to permit evaluation of their virtues in comparison with the single-row engines of similar mechanical construction.

Like the single-row Wasp and Hornet engines, the Twin Wasp and Twin Wasp Junior engines are mechanically identical, differing only in the size of parts to accommodate their difference of displacement of 1,830 and 1,536 cubic inches, respectively, and, except for differences in crankshafts, master connecting rods, and cam mechanisms, they are of the same general construction as the single-row Pratt & Whitney engines.

The two-row engines have 14 cylinders arranged in two staggered rows of seven each. The cylinders of the front row, together with their valve gear, resemble very closely the cylinders of the single-row engines, while for the rear cylinders the cams and valve gear are behind instead of in front, with corresponding modifications in the cylinder heads.

Reduction-gear and accessory-drive assemblies are very similar to those of the

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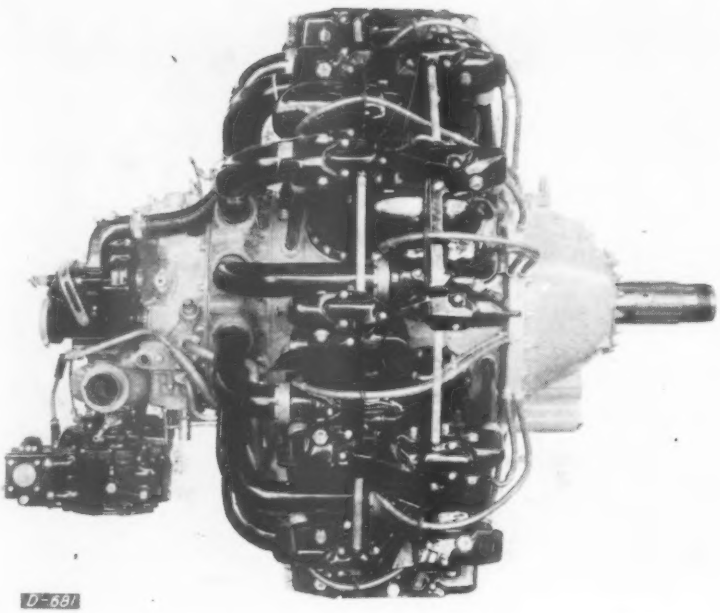

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NEED A WIND SPEED INDICATOR?

by RAOUL J. HOFFMAN

SMALL airports usually are not equipped with a wind gauge (anemometer) so that the pilot or engineer is at loss to know the velocity of the wind at the time it may be required for take-off or else for making scientific investigations on models or airplanes.

Glider pilots, especially, should have an instrument to measure the wind velocity at the location over which they are about to soar.

Therefore a portable and inexpensive instrument to measure wind velocities would supply a long felt need.

The illustration and detail drawing show a simple instrument which, if carefully built, will measure the wind-speed with a fair degree of accuracy. The operating principle is based upon the torque created by a small high-pitch propeller placed in the windstream. It can be used not only for aeronautical purposes but for measuring air velocities at duct and flue discharges.

All material is easily procurable with the exception of the watch spring (⅛" wide) which may be obtained at any jeweler. The dimensions on the drawing do not have to be followed as long as the shaft will turn without binding.

First, lay out the cone; form it into shape and cement at the lap joint. Do not use glue, as the seam may open up in humid air; then cut out the dial, place an eyelet into center hole, flange it with a center punch and hammer it flat.

Next cut the shaft to its correct length; file flats on one end and a slot on other end. Tin shaft with solder on places indicated; locate spring and solder it to shaft. Form a slotted wood block ¼" by ¼" by ½"; place loose end of spring into slot and lock with a pin through the hole already in spring.

Place shaft through dial and cement block to periphery. Then solder eyelet and indicator to shaft; place the whole unit into cone and cement it at the edges, turning shaft to make sure that dial is square with shaft. Cement eyelet on other end of cone; after everything is set, solder eyelet to other end of shaft, leaving a $\frac{3}{32}$" play to insure free movement.

The next step is the carving of the propeller out of a hardwood block. The propeller should be right-handed so as to have a clockwise reading on the dial. Drill a $\frac{5}{32}$" hole in the hub to half of the depth and force propeller onto the shaft.

The final step is the calibration of the instrument and the most interesting detail. Take the instrument for a ride in an open top automobile with an accurate speedometer.

Drive at intervals 10, 20, and 30 miles per hour, holding the instrument as far away as possible and note the speed with pencil on the dial. The remainder of the velocity marks can be found by interpolation. In case a check is desirable the instrument may be compared with anemometers at airports or at weather stations.

After the calibration is finished the instrument is coated with a protective covering of shellac or with similar material.

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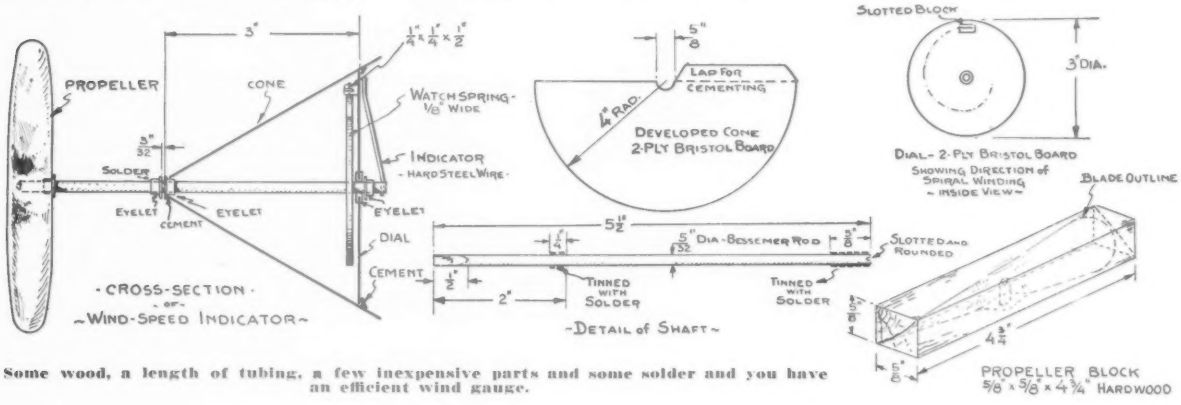


Some wood, a length of tubing, a few inexpensive parts and some solder and you have an efficient wind gauge.

Space Navigation by Rocket

by ALVIN EDWARD MOORE

PART I

In this series of articles, Mr. Moore gives authentic information on the history and development of the rocket-ship which is now engrossing the attention of scientists and engineers.

MOST people think little of the progressive cooling of this planet on which we spin through space.

To most of us, the time when the world will be an extremely cold place, with most of its oxygen absorbed in its cooling limestone—a frigid place like our neighboring planet Mars today—seems far distant. And that time is indeed a long way ahead even if regarded from the point of view of the life of man; but it will not be forever.

The earth has been cooling some two thousand million years. In another million million years there will be Arctic weather at the equator; and the far-off descendants of our generations will need to take ship for another world around our cooling sun.

Of the family of seven planets revolving at different distances about the sun, the earth is the third from the sun. Mars, which is forty-nine million miles farther from the sun than we are, is our next neighbor in outer space. It is frigid already. Life may be on it, but before many ages pass, this life may migrate to our warmer planet.

Venus, our nearest neighbor toward the sun, nearer to us than Mars, is only twenty-five million miles from our earth. It is still as hot as the earth was during Mesozoic times—when the giant dinosaur with its tons of waddling flesh was the dominant form of life on earth. But ten to a hundred million years from now it probably will have the kind of temperature that is fitted for our human life. Then will be the time when interplanetary space ships will be needed by world man to fly to Venus to colonize that planet.

Mankind is already thinking of this far-off need, consciously and unconsciously—through its writers and inventors for the future both fanciful and scientific—through its brave men who dare to down their instinctive fears of the dizzy depths of space and take action at a time when action is extremely perilous.

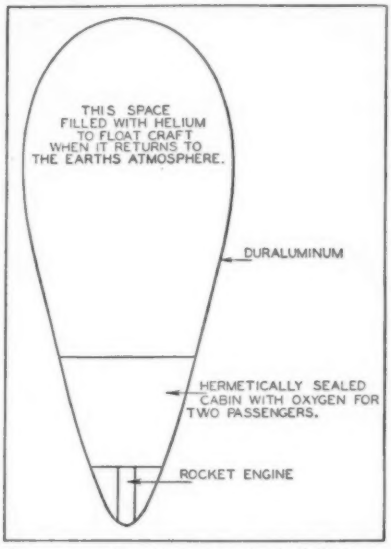
Not least among these daring ones of the mind and of physical action are the inventors and the men of action in craft of the air, the stratosphere, and space. And perhaps the most daring of this daring group of pioneers are the inventors and pilots of the stratosphere balloon and the rocket ship.

Men sometimes say adventure is dead. An epic could be written of the adventures of airplane pilots and stratosphere balloonists in the last decade. And adventures in the rocket-car, sled and ship have just begun, and bid fair to be much heard of during the lifetime and beyond of all those who read these articles on the rocket craft of the future.

The question now among practically all scientists who have thoroughly studied the problems of the rocket is not, will the rocket ship be able to go out into space, but, when will it fly to the moon and return, and on to Venus or Mars? The writer is convinced that most intellectual people who have not thought much on this subject would be surprised at how near in the future these flights are believed to be by fact-finding scientists who have reputations for scientific conservatism.

Rockets are older in the civilization of man than the shot gun; and the dream of going to the moon and distant planets is older than the steam engine.

The rocket is probably the simplest form of engine. It is a reaction engine, which imparts movement to a structural body by



A cross-section through a typical "space-ship" with the streamlining in a vertical plane. A sufficient amount of helium is placed in the envelope to counter-balance the weight while the rocket engine is placed below.

reaction from expanding gases as they escape from the confines of the body. When a charge of combustible powder or liquid explodes the expanding gases exert a great quick force *in every direction.*

Consider a shot-gun for instance. You hold it tightly to your shoulder, for you know from experience what will happen to your shoulder if you don't.

You pull the trigger. The powder explodes into gas, which expands in every direction. The force acting on the movable front wall of the cartridge ejects the shot at high speed.

The forces exerted on the cylindrical wall of the cartridge are transmitted to the gun barrel; and since they act equally on all parts around the barrel it does not move because of them. But the force acting toward the rear of the cartridge, tending to force the breech backward, is resisted by your shoulder and your feet on the ground.

Now, if you should lay the gun on the ground and fire it by a string, it would be catapulted to the rear simultaneously with the exit of the shot. The gun would now be a rocket. Its mass multitplied by its speed to the rear would equal the product of the mass of the shot by its speed forward. Whether the gun is held to the shoulder or free has no bearing on the speed of the shot. But the speed of an ordinary rocket does depend on the resistance presented to the exploding gas by the air.

Many people who haven't studied the subject of rockets, say that a rocket ship would never function in the vacuum of space for there is no air there for the gases to react against. The answer to this is that *the rocket would operate more efficiently in space than in the atmosphere.*

The force operating on the wall of the breech of the gun described above or on the front wall of a skyrocket moves the wall away from the exploding gases; but in order for the wall and the rocket to escape these gases, and thus to move, the gases must force back any air at the rear opening of the rocket's explosive chamber.

This air exerts a resistance to the expanding gas, and this resistance tends to hold the metal part of the rocket back with its gas part—tends to keep the two parts from separating. Thus part of the force of the rocket is expended in overcoming the resistance of the air.

If there is no air resistance—as in space—the rocket motor is almost 100 percent efficient. Moreover a rocket craft would operate more efficiently in the vacuum of space because there would be no air resistance to retard the flight of the rocket. Thus, in theory, the rocket is an almost perfect motor for a space ship.

Heron of Alexandria, Egypt, famous Greek geometer and physicist who lived about the Third Century B. C., built the first reaction engine of history. Two bent pipes led from opposite sides of a spherical container mounted for rotation. Water in the container was boiled, steam issued from the pipes and the reaction from the steam jets rotated the spherical container.

Sir Isaac Newton of the Seventeenth Century also designed a steam engine based on this reaction principle which is so closely associated with his name.

The Chinese have been credited with the basic invention of the rocket. One of man's first thoughts of course was to use it in war. They put inflammable substances in the head of the rocket and put a charge of powder in paper behind, and shot it at the Tartars. This was in the Thirteenth Century.

The rocket came to Europe, where it was used to carry up a charge of magnesium to make a bright light for signalling or

XUM

disclosing movements in the battlefield. But it was dangerous; often it returned to destroy its senders.

Toward the close of the Eighteenth Century William Congreve, an English ordnance expert, became interested in the rocket. He made experiments, based on the earlier work of General Desaguliers, with the object of making a rocket that would carry an explosive or flame-producing charge within a range of two miles. He designed a rocket with a case of iron instead of the customary paper and with an improved explosion chamber and outlet nozzle.

The English Royal Laboratory built rockets on this design. They were used in the Napoleonic War—first, in 1806, from boats against the French town of Boulogne. The wind shifted them from the fortifications toward which they were fired to the town itself, where they did considerable damage.

But the soldiers found them to be very dangerous to handle. The charges often exploded among the users of the weapon rather than those against which it was aimed. Guided only by its projecting stick it was an erratic thing. Neverthless, the British Field Rocket Brigade was formed in 1812; and it fought well before Leipsic and at Waterloo. Before this, however, a humane use for the rocket had been found.

A French pyrotechnicist, Ruggieri, wrote in 1802 that his father had suggested that the rocket be used to carry a line in life-saving and at the same time illuminate the flight of the line. The idea was developed in Great Britain about 1807 by one Trengrouse of Cornwall.

In time, the Schermuly rocket apparatus was developed by William Shermuly of Middlesex, England. In this structure a gun fires a line-carrying rocket toward a wreck or person in the water to be saved. The flash of the cartridge ignites the rocket, which is already on its way before it burns very much. The flight of the rocket can be followed at night by both the sender and the people at whom it is aimed.

As the life-saving rocket gained in use the war rocket declined. The refinement of gunnery, with breech loading, rifled bore and smokeless powder, caused the gun slowly to replace the dangerous war rocket, until by the end of the Nineteenth Century the latter was mainly used for sending up flares.

But man had begun to dream more of conquering interplanetary space, and the slowly improving rocket was the only means so far developed that would enable him, in theory, to leave the earth and its envelope of air. Many were the strange fancies wrought by the imaginative men who first had this dream.

Bishop Godwin of England wrote *Domingo Gonzales* in the early Seventeenth Century. Reasoning that, when the birds left every autumn, they migrated to the moon, he decided to pick a good stout bird that might be harnessed in numbers to carry man thither. He chose the swans of the East Indies to carry his space chariot and reasoned that they "could be taught to carry men by having a machine to divide the weight between them."

(*Concluded on page 66*)

A British Light Autogiro Jumps with 45 h.p. Engine

by ERNEST NAGY, Jr.

IT is no doubt true that the greatest progress in the evolution of the autogiro was the introduction of the direct-start principle. The first autogiros took off only after considerable run; now it is possible to get in the air after a run of 10-15 feet.

Cierva Autogiro Co. and G. and J. Weir Ltd. have evolved now a new rotor head of the so-called "autodynamic" type. This is much more simple than all previous systems. The new Weir autogiro, named officially the Weir W-3 light autogiro, is a single-seater, in which all the new features of autogiro construction are incorporated.

Power is supplied by a 45-50 h.p air-cooled in-line Weir engine. The whole machine consists of these few parts: a box type wooden fuselage, engine, an undercarriage of very wide track and long travel, a steel tube pyramid carrying the rotor head and blades. A wooden airscrew with Schwarz finish is fitted.

It has neither ailerons, elevators nor rudder. Fixed vertical and horizontal fins are fitted and the movements of the machine are directly and entirely controlled by tilting the axis of the rotor hub. The picture shows the Weir W-3 making a jump-start.

When the rotor is speeded up to 550 r.p.m. by the engine, the machine can jump to 20 ft. and then start flying horizontal without any sink. During the jump the tail rises first and after the 20 ft. level has been attained, the machine takes a normal flying attitude. The cost of the production type Weir W-3 will be about £500, i.e. $2500.

A striking demonstration of the new British Autogiro, that lands almost at zero forward speed.

New Dope on Bird Hostilities

AS this issue goes to press, we hear more rumors to the effect that the eagles are attacking planes in the Rocky Mountain regions.

When one gets the same report from three different observers within two weeks, it would seem that there was something in the story of a Golden eagle picking on a Waco and clawing the pilot, but the learned men in museums tell us that such action is contrary to the disposition of the bird—and there you are.

We ran a story on an eagle hunt some time ago that was questioned by scientific men but, on the other hand, praised by dwellers in the mountain districts, who should know what they're talking about, but whom we are starting to doubt.

"Aw, don't be scared Josie—it's yellow! Dozens of times I've dared it to stop and fight."

The Aeroneer Model 1-B Lightplane

This is a most recent addition to the realm of all-metal sportplanes—It is now ready for production after exhaustive tests

A VERY interesting development in all-metal planes for the use of the private owner will be seen in the Aeroneer Model 1-B plane, now being produced in California.

This new plane is very completely equipped with many modern features usually found only on large commercial ships. These include adjustable trimming tabs on the elevators, semi-adjustable tabs on the rudder, full cantilever single-strut landing gear, steerable tail wheel, differential hydraulic brakes and transport low-wing construction. It is of all-metal construction with no external bracing of any description.

It is quite interesting to note that the design and construction of the Aeroneer has been conducted under the supervision of such notable aeronautical engineers as Dr. Arthur L. Klein, W. C. Rockefeller, Carlos Wood and Milford Childers, all of whom have had extended experience in the design of large transport planes as well as those of the private utility type. Dr. Klein, it may be said, is associate professor of the California Institute of Technology and also consulting engineer for the Douglas Aircraft Company and its subsidiary, the Northrop Corporation. The Aeroneer, however, is purely a private venture not associated in any way, either with the university nor with the above mentioned companies.

Fully loaded, the Aeroneer averages better than 17 miles per gallon of gasoline at its cruising speed of 138 m.p.h., which is ample proof of its excellent aerodynamic qualities. The tank capacity mounted in the standard plane gives it a radius of 750 miles with full load or a sustained flight of over 5 hours at cruising speed. The 25-square foot split flap flap air-brakes reduce the landing speed to a safe and comfortable figure.

Side-by-side seating for the passenger and pilot is provided, with ample room for comfort in a commodious cabin that allows for plenty of leg-room. The overhead enclosure, giving ample visibility, is made of Plastecele and is so arranged that it can be easily and safely adjusted while the plane is in flight. A pyramid of steel tubes, directly behind and extending over the heads of the passenger and pilot affords additional protection in the case of accident.

Side elevation of the Aeroneer Model 1-B all-metal plane, powered with a Menasco C-4 125 h.p. engine.

Power is provided by a Menasco 125 h.p. Type C-4 engine mounted on a chrome-moly steel tube structure which is attached to the firewall. Cast dural brackets from the engine attach to Lord fittings which in turn attach to the motor mount. An Evans type fuel pump is used for pumping the gasoline to the carbureter while a standard oil pump draws oil from an aluminum tank placed between the engine and the firewall.

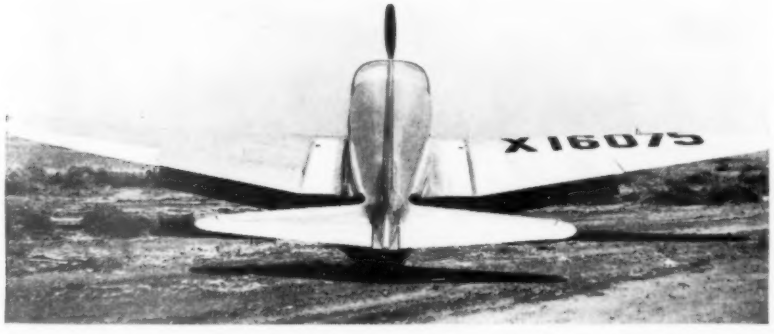
Gasoline storage and supply are divided into three groups. (1) The two main wing tanks in the center-section and on either side of the fuselage. (2) An auxiliary tank placed in front of the instrument panel. The fuel supply is controlled by a selector valve, ahead of which is a wobble pump which, in an emergency, may be used to completely fill the reserve gravity tank or, in case of fuel pump failure, it is possible to draw gas only from the reverse tank which feeds the carbureter by gravity. The wing fuel tanks, it will be noted, are distant from the motor area, a factor that contributes to the safety of the passenger and pilot.

In general, the all-metal construction of the Aeroneer is of the stiffened skin monocoque type, the covering being 24 ST A1-clad. This stressed skin is riveted in the same way as the metal covering of large transport planes and all-metal military types. The wings are of single spar design easily demountable and provided with easily removed wing tips and a semi-detachable leading edge which reduces the time and expense required for repairs. A removable tail cone and removable floor boards facilitate the inspection and repair of the control system.

The stainless steel fire wall of .016 thickness is built into the front end of the fuselage structure proper; just aft of this fire wall are heavy members which are used to carry the stress in the fuselage past the cabin section. Fittings are riveted and bolted to the front end of these members, which fasten to the motor-mount by means of tension bolts. These heavy fuselage members continue over a station aft of the cabin location in the fuselage. Vertical stiffeners are used between the two heavy members on each side of the fuselage, and are designed in such a way that the sides of the fuselage at the cabin section are used as Wagner beams through this section of the fuselage.

Due to the fact that this cabin section is not totally closed, four chrome molybdenum steel tubes are built into the structure to take the torsion from the rear of the fuselage down to the wing, to stiffen up the structure around the cabin and take any of the impact loads in possible case of an over-turn. Aft of the cabin the heavy members mentioned heretofore fade out and a stiffener system to carry the loads imposed on the fuselage fades in, thus changing the type of structure from one of a pair of Wagner beams to a normal type of stiffened skin construction.

(*Concluded on page 62*)



View of the Aeroneer Model 1-B taken from the rear showing the clean lines of the fuselage and the wing posture.

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The Problem of Span Loading

LATELY, amateurs have been pondering over the span-loading and in order to obtain a low span-loading and small wing area at the same time, they have developed a wing which has an aspect ratio which is away too high for any practicable advantage since the strength of the wing is greatly reduced and for which much excessive weight has to be added.

In designing any airplane, except for racing planes, the largest practicable aspect ratio is used since the effectiveness or efficiency at the speed at which the airplane will climb is important. This is especially true of light planes. Rarely is an aspect ratio of lower than 4 used, even on racing planes. The largest practicable aspect ratio is 8.5 or 9, the reason being namely:

(1) The thickness of the wing for a given wing section and specified area decreases as the aspect ratio is increased which means that the internal structure will be very shallow which complicates the wing beam design and most of the strength will be through external bracing. This means added parasite drag and weight and the advantages of the high aspect are offset.

(2) A high aspect ratio means a large span. Hangar space (an all-important subject with the amateur) is increased and rental higher if the cost is so much per foot of span. Also, a longer tail-length is required which will add to the weight.

The aspect ratio for a rectangular wing is the span divided by the chord, b/c. If any other planform is used the aspect ratio is found as the square of the span divided by the wing area, b^2/S.

The wind tunnel tests made by the N.A.C.A. are on model airfoils having an aspect ratio of 6. Some other laboratories use an aspect ratio of 5. The exact dimensions should be noted on the data sheets in any case.

The induced drag, found as,

$$\text{Induced drag} = \frac{C_L \times \text{Lift}}{3.14159 \times \text{A.R.}}$$ is greatly affected by a change in the aspect ratio. Curves derived from various data for the corrections for lift and drag coefficients for various aspect ratios are given in Table I.

The corrections are unity for an aspect ratio of 6, as most all airfoil data published in this country by the different laboratories is for this value.

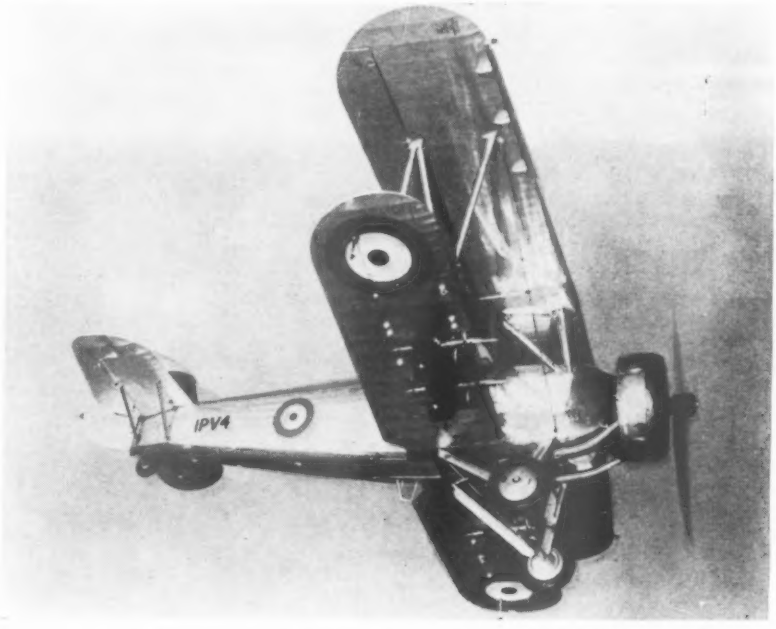
Taking as an example a light plane with a gross weight of 850 lbs. using a Clark "Y" wing section with an aspect ratio of 6, the wing area required =

$$S = \frac{850}{1.56 \times .07651 \times 44^2} = 244.2 \text{ sq. ft.}$$

$(C_L)\ 2 \times 32.2\ (V^2)$ in ft. per sec. if a landing speed of 30 m.p.h. is desired. The span would be 38.2 ft. If an aspect

(Concluded on page 64)

The New Hawker Biplane Dive Bomber



Authenticated News Photo.
The Hawker Dive Bomber in Flight with bombs in racks.

THE PHOTO shows the new Hawker Dive Bomber photographed at the instant that the pilot had put it into a steep bank, just before going into a dive.

This dive-bomber carries 1,000 pounds of bombs and reaches a level speed of 215 m.p.h. with the pilot, fuel and full load of bombs. The diving speed when bombing is well above 300 miles per hour and it is said that its diving stability and steadiness is quite remarkable. The biplane structure rather suggests the swept back wings of the old American Hell-Diver that was so popular a few years ago.

A Home-Built Russian Lightplane

IN the land of the Soviet they are getting the lightplane fever as will be seen from this view of the one-seater training plane built by V. K. Gribovsky. It is equipped with a 50 h.p. engine, has a maximum speed of 110 m.p.h. and a cruising speed of 100 m.p.h. The landing speed is 35 m.p.h. which is an excellent speed ratio for this type of ship.

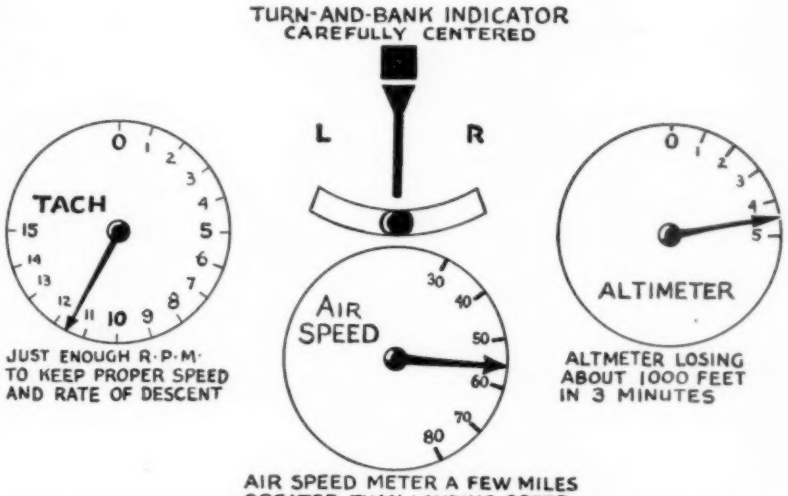
The plane weighs 485 pounds empty and carries a live load of 264 pounds. The span is 28 feet and the length is 17 feet. Only wood is used in the construction.

This is really a creditable job for a home-built trainer.

Crashing Gracefully—and How!

by T-2003

The author tells us that the narrator of this tale is a well known pilot of many years experience, at present engaged in piloting a rich play-boy around the country. His experience agrees with that of the Army Air Corps which teaches the low-speed power glide as part of the blind-flying course.



How things look on the instrument board on the power-glide, easing her down through the clouds with the nose up.

MUCH as I love flying, I remember cursing the day I ever took it up as a means of livelihood. That was when the thin mist near St. Louis, that I had believed to be nothing more than smoke, turned into an honest-to-goodness fog.

By that time I had passed over the city, couldn't see Lambert Field, got scared of cracking up in the city streets if I turned back, and made a wide detour to the west to get back to the fog-free area whence I had come. Then I couldn't find the fog-free area at all. That was when I thought flying for a living was a not-so-hot occupation. So I started cursing the day, etc.

Then I remembered I had started flying for the fun of it, and not to make a living. So I started cursing myself.

I was getting on the right track, all right, I was to blame for everything, but not because I'd taken up flying for fun. Where I was at fault was in not noticing the increasing haziness on either side of the Mississippi River as I flew up this river on the way to St. Louis.

Having pulled one boner by blundering into the fog I blundered into another. Like coming out of a spin with your stick way back and too much reverse rudder and promptly falling into a spin on the other side. This time I wanted to get out of my jam in a hurry; get back to the Mississippi and return south. Couldn't do it fast enough; so I pushed the throttle all the way forward and felt my way down with the partial aid of the turn and bank indicator and compass toward the tree-tops which I intended hurdling until I reached the river. The fog was rapidly getting worse, I mustn't lose any time getting back to the river. So I kept the throttle way forward, and gave it an extra push for luck.

The trees jumped out of a hollow in the fog and I pulled up a bit and skimmed over their tops. East for five minutes. I must be southwest of St. Louis. I'd see the river any second now. Some more minutes. No river. Patches of fog were right down on the ground. I slammed right into them. Then came out into open spaces with fifty feet or so clearance above the trees and low hills.

Twelve minutes of flying east. No river. Eighteen minutes and still no river. I must be over Illinois now. Fewer trees, slightly flatter country. Better keep on east and land in the first open field I could find, before the fog closed in completely. No time to lose. Still full throttle and still flying east. Patches of fog. Leaning half out of the cockpit to see what was ahead.

Maybe that was why I was flung clear as she hit at 105 m.p.h. Wing hooked a tree and it was a mile before the plane stopped rolling, in a ball.

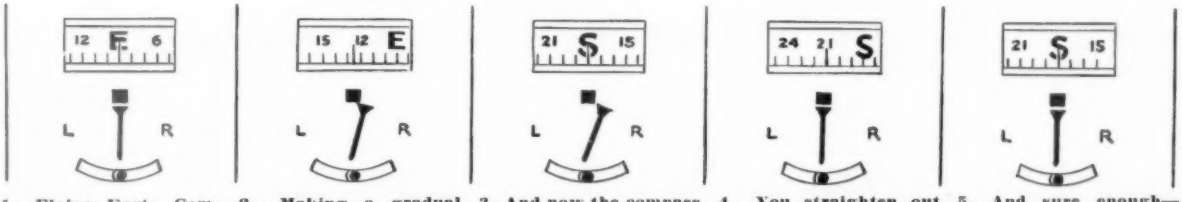
The farmer in whose field I ended up was a peach. Turned his home into a hospital for one month and charged me only $50.00 for board, lodging and tender care, while I recovered from shock, several deep cuts and multitudinous bruises. Doctor's services $10.00 or more. Plane reduced in value from about $2,250, current second hand value, to the $30.00 I got for it from the junkman.

That month of rest, plus the next planeless year, I had plenty of time to think things over. I had been flying for five years and had about 1,000 hours to my credit. What *should* I have done to have avoided the crack-up? Did I know all there was to know about the weather, the plane, the instruments, the engine,—or myself? Evidently not. Could I learn? Why not. So I set about learning.

Up to that time I had taken flying as a matter of course. I had graduated from a fairly good flying school, according to 1922 standards, but I know now what little real instruction, outside of the mere handling of an airplane, I had received. Through books, through little experiments of my own, through questioning pilots who were really experienced and not just Big Noises I learned a lot.

Take the magnetic compass. Did you know that it will hold steady when you're flying in an easterly or westerly direction but that it swings off very easily when you're headed North or South? Most every pilot knows that. But did you also know how it acts *when* you're turning?

Well, you make an easy turn to the East or West and when the compass says "E" or "W" that's where you're headed. But turn to the North or South and the compass acts goofy. To turn South you must turn



1. Flying East. Compass dial above, bank-and-turn indicator below.

2. Making a gradual turn toward the South, noting the left hand swing (toward L) of the turn indicator.

3. And now the compass says "south" but don't straighten out yet.

4. You straighten out now because you are really headed south.

5. And sure enough—the compass which has over-swung, now turns back to "south."

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until the compass has passed "S" and has gone about 25 degrees beyond. Then you're headed South.

Hold your plane there for half a minute, by your turn and bank indicator, and the compass card will swing back again and steady on "S." It is just the reverse when turning toward the North. About 30 degrees before the *card* registers "N" you are already headed North. Stop your turn then and hold the plane there and the *compass* will continue its turn until it faithfully registers "N," as it should.

In 1927, when I was doping all this out the Air Service was just starting its Inspection System. They claimed to have reduced forced landings due to mechanical failure by 50 percent. So I doped out a system of periodic inspections for the next ship I bought. Even the manufacturers of the plane and engine couldn't help me much on that. They were too busy selling airplanes to worry about their purchasers' problems after the ships were sold.

Also, they wouldn't admit that their equipment needed periodic inspections. But if the biggest user of airplanes in the country, the Air Service, found the system profitable, so should I. Result:—not a forced landing due to mechanical failure with my three ships since 1928. (Knock on wood.)

Take fuels and carburetors. I learned that I was paying 30 percent more for certain "aviation fuels" for my dinky little 220 h.p. engines than for the gas for my 75 h.p. auto, yet the auto engine got twice the beating that the aero engine did.

I never gave the latter full throttle until I had warmed engine and oil up very carefully at idling speed, but my car would start up, and the next minute be hitting 50 m.p.h. down the road. And the "aviation fuel" which costs me considerably more was very little, if any, different from that which I used in my car.

Imagine yourself on a cold day, flying blissfully along. Suddenly your engine acts sluggish. From the exhaust's odor you suspect it's due to an overrich mixture. Do you know the cause? Ice, probably, has formed in the venturi tube of your carburetors, from icy, damp air rushing through the tube and suddenly expanding. Know the simple remedy?

Open up your altitude control, if you have one, until the engine backfires from the over-lean mixture. The chances are that the backfire will blow out the ice from the air intake of the carburetor. Or, close the fuel supply valve and the engine will probably backfire when the gas level in the float chamber gets low. That and many other things I learned myself.

And then I busted into some fog again, but this time voluntarily.

From the wilds of west Texas I was rushing a dangerously ill youngster to the hospital at San Antonio. The kid had a few hours to live, unless he reached the hospital where an emergency operation could be performed. Money was no object to his parents, they had told me when I took off. The idea was to get the kid to the hospital in a hurry. One hundred miles from my destination things started to shut in.

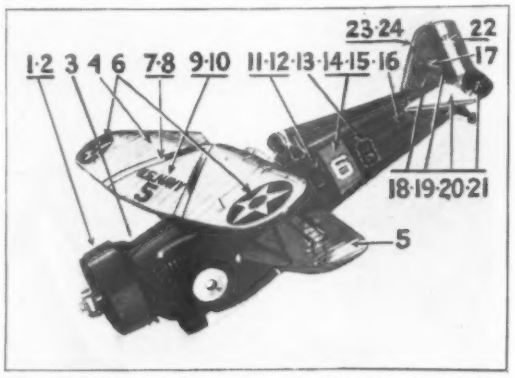
(*Concluded on page* 52)

Here's What's Wrong with That Picture!

(See back cover of January issue)

WELL, a whole lot of you fellows wrote in telling us what the errors were on the Curtiss Fighter pictured on the back cover of the January issue, but most of you were very far off the track.

This colored back cover picture, as you will no doubt remember, shows a Curtiss Fighter intended to represent the leader of the 2nd Section, 6th Fighting Squadron, attached to the U.S.S. Saratoga, but the artist intentionally messed up the colors and markings just to test your knowledge of standard naval insignia.



The reference numbers shown in this drawing correspond to the numbers in the list of errors.

Now, after you have had a month in which to study and think over the matter, we'll hand you the real info so that you can check up on the markings and colors. And when you absorb all that the following table has to explain, you'll really know something about insignia and colors. Mistakes are given in capital letters.

1. NOSE SHOWN HALF COLORED. The entire nose of a leader's plane should be colored.
2. WRONG COLOR SHOWN ON NOSE. Nose of 2nd section is all white.
3. WRONG COLOR FOR FUSELAGE. Should be gray.
4. WRONG COLOR FOR UPPER WING. Should be chrome yellow.
5. WRONG COLOR FOR LOWER WING. Should be aluminum.
6. U. S. NAVY INSIGNIA IMPROPERLY PLACED. Should be located a distance from the wing tip equal to chord.
7. CHEVRON SHOWN REVERSED. Chevron apex should point forward.
8. CHEVRON COLOR WRONG. Should be white to agree with section color.
9. NUMBER WITHIN CHEVRON IS WRONG. Leader of 2nd Section flies plane No. 4.
10. U.S.N. ON TOP WING. No letters should be placed on top wing.
11. PORTION OF SQUADRON LETTERING REVERSED. Squadron number should precede mission letter.
12. "O" IS WRONG IDENTIFICATION. Should be 6F for 6th fighting squadron.
13. PLANE NUMBER IS WRONG. Number for leader of the 2nd section should be No. 4.
14. BAND INCOMPLETE. Band extends completely around fuselage.
15. BAND IS WRONG COLOR. Should be white, same as section color.
16. U.S.S. SARATOGA WRONG. U. S. Navy placed on each side.
17. SQUADRON INSIGNIA IN WRONG PLACE. Squadron insignia should be forward of squadron markings.
18. VERTICAL FIN WRONG COLOR.
19. RUDDER WRONG COLOR.
20. HORIZONTAL STABILIZER WRONG COLOR.
21. FLIPPERS WRONG COLOR.

    In the above four errors it should be particularly noted that all squadrons attached to the U. S. Saratoga carry all white tails.
22. PLANE NUMBER IN WRONG PLACE. Plane number should be on vertical fin surface.
23. SERIAL NUMBER IN WRONG PLACE. Should be placed on rudder.
24. WRONG SERIAL NUMBER. The correct serial number is BF2C-1 of the Curtiss plane shown.

A Novel Lightplane Engine from Oklahoma

A REMARKABLE little lightplane engine has recently been built by Robert Huggins, 1319 West 23rd Place, Tulsa, Okla., which is rated at 35 h.p. It is of the four-cylinder in-line air-cooled type that is particularly adapted for the nose of a small ship.

It has been given a block test of 100 hours at full speed without sign of failure in any of its details. In regard to price, it stands between the nearest equivalent production engine and a Ford conversion with specification equal to those of the highest priced engine. It is quite light for this type of engine and should be popular. The specifications are as follows:

ENGINE SPECIFICATIONS

Cylinder bore	3 1/16-in.
Cylinder stroke	4-in.
Displacement	117 cu. in.
Rated horsepower	35
Weight, dry without hub	137 lbs.
Drop drive, Anti-clock	Direct
Tach drive	½ Spd.
Ignition	1-Scintilla
Carbureter	1-Zenith

It almost goes without saying, that an in-line air-cooled engine presents many advantages in regard to the reduction of parasitic resistance and propeller efficiency. And these power-savings are of particular importance with lightplanes where there is no power to waste.

Aeronautics A La Cow Pasture

by WILLIAM L. HOPSON

Being a detailed report—humorous no end, we must admit, but nevertheless detailed—of an old-time airman's impressions of the good old days of hayfield airmanship as compared to today's aeronautica.

I STOPPED in at Union Air Terminal at Burbank one afternoon not long ago, and as I went out through the swinging doors of a cool waiting room not unlike a railroad station a plane took off.

It was a big plane—a long bellied, silver monster of all metal construction and as sleek as a greyhound—and with two motors roaring at full throttle it hurtled down the long paved runway, slid into the air and quickly grew into a tiny speck on the horizon.

The crowd thronging the fence in front of the waiting room was about to turn away when a small boy suddenly pointed upward to a trim low winged monoplane barreling down at a two hundred and fifty mile per hour clip, the droning roar of its one thousand horsepower motor filling the heavens. Twice it circled the field to kill speed before the pilot cut the throttle and came in for a landing at one hundred miles per hour.

Colonel Roscoe Turner had returned from an afternoon jaunt in his Gilmore racer.

And looking at the busy scene about me, I somehow had to grin. I thought of another Sunday afternoon one day eight years before in a little town far up in Utah, and the scene changed. Waiting rooms and hangars and paved runways gave way to a dusty cow pasture.

The crowd were transmuted into gawking farmers. The trim low winged transcontinental Boeing transport with its two seven hundred horsepower air cooled motors changed into an oil spattered, creaky, 90 horsepower OX5 Standard. I found myself in the front cockpit, my nostrils filled with the never to be forgotten smell of burned oil. Behind me, holding my life in the greasy palms of his two hands, was Slim, a vagabond pilot.

For I was about to thrill the crowd below with a wing walking exhibition.

Slim levelled her off at seven hundred feet and eased back on the throttle a bit. This to hold down the blast from the prop as much as possible. "All right!" he shrieked above the scream of wind through flying wires and I stepped out into the terrific wash of the prop and made my way over the leading edge of the wing to the rounded tip.

I didn't hang on to a strut and wave bravely at the ant-like figures below; not on the OX5 jobs. Four feet below my goggled eyes I could see the aileron pressed downward to the limit and I knew that Slim had the stick all the way over in the cockpit; yet the wing still kept dropping down. I weigh a hundred and sixty.

So I hurried back, went over the top of the nose behind the groaning motor, avoided the spurting exhaust stacks and went out along the leading spar to the other tip; back again hurriedly. We always walked the leading edge, for this made it safe. It isn't easy to fall off with an eighty mile gale slamming you into the wires; like a newspaper clings to the front of a speeding automobile.

The landing-gear came next. To slip down from the edge of the wing to the spreader bar was a comparatively easy matter, though that wooden prop spinning two feet from my back always gave me a tight feeling in the stomach. I used to imagine what would happen if my foot flicked out into its path. I got a pretty good idea one day several months later when I saw a drunk pilot fall into the prop he was trying to swing. It cut him all to hell.

We didn't do much on the landing gear as a rule. Once in a while I locked my legs in among the struts and hung head down with the blast of the prop tearing savagely at my clothes and the struts cutting deep into the flesh, but not often.

Mr. Hopson, the subject of this picture, is just about to perform.

I usually just went down from one wing to the spreader bar, pulled myself across to the other wheel looking strangely out of place hanging in space, and up to the other wing. That was all. Only on special occasions did we fasten a couple of cables to center section bolts of the upper wing and thence to a belt around my waist, and then loop while I stood upright with arms outspread. Our price on that one was a hundred dollars.

In those days airmen were looked upon as reckless daredevils and we tried hard to live up to that reputation by scaring the daylights out of them. One of our favorite tricks was to stuff a dummy man filled with straw into the front cockpit when I went up to walk the wings. Since people crowded around the ship at every opportunity I usually had to wait at the other side of the field and go up from there. After finishing my wing walking I'd climb back into the cockpit, we'd fly over the crowd and toss out "Elmer."

We quit that stunt when a woman went into hysterics one Sunday afternoon.

There was another one, too, and the last time we pulled that was up in Idaho. Three of us—Slim, myself, and Sam something-or-other, who'd cracked up his own ship and was just out of the hospital—left Salt Lake City early one Saturday morning in the Standard and that afternoon arrived in the town where Slim had lived as a boy. In the town there lived a very, very old lady, Granny Winton by name, that Slim had known since he was a kid. And while the three of us were eating supper in the hotel that night Slim got his big idea.

Why not advertise that Granny Winton, ninety-two years old, was coming out to the field tomorrow to take her first airplane ride!

Both Sam and I turned thumbs down on the idea. God knows it was bad enough to look people in the eye, blandly tell them that they were safer up in the ship than in their own car—when as a matter of fact all were taking their lives in their hands every time they went aloft in the rickety old crates of those times. But Slim was set on the idea. He went to see the old lady right after supper.

The crux of the matter was that we hunted up the local printer, got him to open up and print some handbills announcing the great event, and when we turned in that night every window in town was plastered with the announcement. The next day every citizen came out to see Granny do her stuff.

At one o'clock Slim did his stunting. At two o'clock Sam walked the wings. At three o'clock I went up and jumped out with a chute. And at four o'clock—Granny failed to show up!

When the crowd finally began to get impatient, Slim and the printer drove in in the latter's car to see what the trouble was. Sam took over the flying and I kept on selling tickets.

Half an hour later the printer came driving back with Granny bundled up in the seat beside him. A black shawl was spread over her shoulders to keep her from getting chilled and tied down over her head was a faded sun bonnet.

Slim had said, in rebutting our protests, that the venerable old lady was pretty spry for her age and now she got out of the car and walked over to the plane and was helped in. Almost lifted in. The crowd gathered around to gawk, some of them joking at her; others appeared a bit worried. Sam was sitting indifferently in the rear cockpit with motor idling.

And then Sam did something that no careful pilot would think of doing: he got

XUM

out of the ship and went over to the water bucket that we'd hired a couple of kids, on the promise of a ride, to keep filled. Granny sat very small in the front pit, poking her bonneted head this way and that, staring at all the strange gadgets.

Then it happened!

Her hand must have touched the dual throttle in the front cockpit for suddenly the motor gave a bellow of power, dust flew out from behind, and as Sam came running and yelling the ship started lumbering a zigzag course off across the pasture. Women shrieked; kids yelled; men ran around like frightened ants. And then, with wings wobbling dangerously, the plane left the ground!

It zoomed sharply, half stalled and spun around on one wing. Some drunk ran out to cheer wildly but promptly legged it for the safety of the cars again as the ship headed for the crowd. He shot in between two parked cars and kept right on going.

The plane cleared the crowd with feet to spare, slid off on one wing and almost into the ground, wobbled into the air again. At that instant the motor cut out. The Standard came in for a landing, bounced five feet and headed for the cars again. Amid a mad scramble on the part of the spectators it rolled to a stop. I cut the switch.

With Granny apparently none the worse for her wild ride, everybody ran out and crowded around. Up in the front cockpit Granny, her bonnet somewhat awry, was shaking convulsively as though from the ague.

"Poor old thing!" blazed one indignant lady belligerently and loud enough for all to hear. "It's a good thing for these aviator fellows that *I'm* not the sheriff of this county! They'd find out in a hurry whether they could risk peoples' lives."

And then Granny did a strange thing. Shrieking with laughter she tumbled out of the cockpit to the ground as we made the crowd get back; rolled over and kicked both feet high into the air. Her skirt fell away to reveal a pair of scuffed and worn flying boots and greasy whipcord breeches.

"You—you oughta seen the look on that drunk's face when I dove the ship at him!" whooped Slim and went off into howls again. By this time the crowd had gotten wise and were taking it as a good joke on themselves.

What they didn't know, though, was that Slim actually had intended taking the old lady up. We'd taken lots of others, including one old gentleman ninety-seven years of age. But when he had mentioned it to her —nothing doing! Instead, she'd loaned him one of her outfits to fool the crowd.

Oh, yes, Slim had the extra stick concealed in the folds of his dress when he got into the ship. Sam had, on the pretext of examining the cables in the front cockpit, hooked up the rudder bar and dual throttle.

But that was in an era long past. We're living another now: an era of licensed planes and pilots and regulated flying. But we're fast emerging out of that one and entering still another.

The kind when friend wife will sit in the back of the cabin and give poor hubby hell for not holding out his hand when he shot around the corner of that thunderhead.

Death!

Spanish bomber in action.

SUDDEN, blasting death is depicted in the above rare action photograph of the Spanish civil war. The loyalist bomber has just dropped its load of bombs on a strategic rebel position. That the airman's aim was deadly is attested by the cloud of smoke. It was a direct hit.

De Havilland Dragonfly

THIS small British-built transport is designed for airline operations in various British colonies. The Dragonfly is powered with two Gypsy Major engines of 130 horsepower each. It's a five passenger ship, has a cruising range of 900 miles and cruising speed is 125 miles an hour.

The Dragonfly takes a bow.

Spin Solution?

". . . Pilot Blank could be seen fighting desperately to bring the gyrating airplane out of the deadly, thrashing spin. Apparently, his efforts were useless for, a few seconds later, spectators turned their heads as the ship crashed in a shower of flying metal and fire. . . ."

READING an account of 300 men gathered in a small room and watching a plane go into a tail-spin almost immediately above their heads, one's mind is apt to conjure a picture of a death-chamber from which an escape would be nothing short of miraculous.

Miraculous is the adjective which aeronautical engineers are ascribing to the most important new piece of scientific equipment in aircraft, designed to avert such calamities as related in the newspaper notice at the beginning of this article, and demonstrated at the recent Annual Engineering Conference of the National Advisory Committee for Aeronautics.

This "free-spinning" wind-tunnel of the N. A. C. A. is expected to save not only the lives of passengers in planes but also of test-pilots who take risks in testing full-size model planes. Only recently James H. Collins, a test-pilot, lost his life and his successor narrowly avoided a similar fate by taking to his parachute near Washington a few weeks ago.

The "free-spinning" wind tunnel is located at Langley Field, Virginia; is 15 feet in diameter and has a working height of 27 feet. The wind-speed can be varied from 15 to 50 feet a second. Scale models of any airplane may be put into a so-called "tail-spin" or even the more dangerous flat spin, and the controls automatically operated in an effort to break the spin.

The model plane is piloted by a clockwork through all its operations. After a few minutes of spin the clockwork "pilot," which is set in advance to send the model through its paces, suddenly shifts the rudder, and signals with a green light that it is trying to pull out of the spin in the ordinary way the operator of a plane attempts to recover from a spin. In less than a minute later, the "pilot" signals again, this time with a tiny red light which indicates that a dive is to be attempted.

Simultaneously the elevators shift for the dive. The plane noses over and plunges through the air to the bottom of the shaft, where it is caught in a net.

The use of conventional wind-tunnels has revolutionized the shape and construction of aircraft; this new type will add to the safety of planes. The vertical wind-tunnel differs from the horizontal type in that the air rushes upward, against the pull of gravity and makes it possible to literally balance a small airplane on air. In this way an observer can study as often as necessary the performance of the model plane in many difficult situations.

Both major and minute changes of design can be tested in this tunnel and the engineer may be assured that the full-scale model of the same craft will perform in real flight substantially as his model does. Government aeronautical scientists hope to

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"....Clear and Unlimited"

by SWANEE TAYLOR

Our versatile commentator, in his highly interesting and entertaining manner, makes pertinent remarks concerning doers and doings in aviation.

THIS month's chore, in case you are interested, is written high in The Book-Cadillac, Detroit, which is as lonesome a place to tangle with insurgent Spanish influenza as you can find anywhere. Merciful heaven, what misfortune it is to be taken ill in a bleak hotel room!

Our Commentator, Swanee Taylor.

In my case, however, an ocean of friendly warmth swept unexpectedly into my sick-room with a bale of flowers from The Songbird of the South and her manager who happened to be tarrying in town. Such a nice person, Kate Smith; so consistently considerate of human misery and loneliness. And the same goes for that grand Irishman, Ted Collins, who takes care of her business affairs.

One thing is certain. I shall forevermore drink nothing but A & P coffee to show my appreciation of the sponsors who make it possible for the dear Katherine to go about in the world spreading sunshine and happiness in the high places and the low. Besides, it's mighty elegant drinking java.

News Beat . . .

One of a columnist's cherished prerogatives is to toot his own horn over scooping the world with a news item. Well, we'll spare the horn blowing this time and I'll just break down and hand you the first list published of prize winners in Berry Brothers' Waco Contest which ran in the October issue of Popular Aviation. Here it is:

1st Prize $50

B. E. Zeigler, 281 Barr Ave., Teaneck, N. J.

2nd Prize $25

Morris Jorgenson, Lisbon, North Dakota.

3rd Prize $15

Larsen O. Brown, 33 Academy Ave., Pittsburgh, Pa.

4th Prize $5

Bruce R. DeMerritt, Jr., 110 Wakefield St., Rochester, N. H.

$1 runners-up

Elliott Parker, 16 Willard Ave., Mount Vernon, N. Y.

Donald Yeates, 165 Spring St., Gloversville, N. Y.

Wm. Griswold, 5645 S. Wells St., Chicago.

Thos. R. Parrott, 2700 Greenwood, Louisville, Ky.

Alvis A. Lee, Gen. Del., Hamlet, N. C.

H. A. Stovall, Box 351, Ralls, Tex.

Chas. Coder, 91 Clifton Pl., Jersey City, N. J.

Ernest E. Miner, 9 Jefferson Ave., Endicott, N. Y.

Archie Anderson, Falls Church, Va.

Leslie Papier, 415 S. Darling St., Angola, Ind.

Clutch Slipping???

A most noteworthy feature of the November annual meeting of the National Aeronautic Association, in Chicago, was one unmistakable sign that Cleveland's mighty National Air Races Inc., is about to lose its greedy grip on the exhibition pilots of this country.

The promoting brothers were all a-dither over the competition to come from a new organization called, National Air Shows; organized and managed by Ted Fordon and Bert Brown, of Detroit. And I believe it would have done your hearts good to have seen the "Races" brother, act bellowing that old call for "Co-operation!" after the "Shows" partners. Would you believe it, they want the Fordon-Brown outfit to open up their show and stick in some silly races??

Here is how the whole thing stands at the moment of writing. Ted Fordon and Bert Brown have corralled the country's best acrobatic and exhibition pilots for their National Air Shows organization. (Those they haven't got already they'll have darn soon.) Which, plain to see, is going to be a large bitter pill for the Cleveland Races to swallow. Fordon-Brown have booked their shows pretty nearly solid for 1937, and at prices to the performers which make Cleveland's pitiful wages look even stingier by comparison. The boys now get a year's good living, as a minimum guarantee, with every chance in the world to clean up $10,000 to $15,000 for 9 months work. No longer will these sterling performers (the men who've carried the National Air Races from year to year), have to risk life and limb for a pittance while others reap the profits and glories that go hand in hand with ruthless wealth and power behind the Air Races Corporation. Nor will it be required of these men to face starvation and/or annihilation so that the promoters can grab their fat percentages and build movie mansions in movieland.

The tough part of it all—from the Cleveland viewpoint—is that the National Air Races 1937 are going to be in a tight fix for air acts. Fordon-Brown are booked for the Cleveland dates and can't be had for any price. Of course there'll be a few foreign pilots over here, but an air race audience can stand just so much low-power inverted flying—then it's time to lose your lunch.

From the racing standpoint this year's meet will be excruciatingly painful. I know already that there will be at least three Italian ships over here after that heavy money. Which means that we might just as well advertise them as the European Air Races 1937 and let it go at that. The prospect looks, indeed, pretty dull. And the ones to lose? Why the buying public, of course. Who else ever loses

Some of the entertainers at the amateur night aviation ball and minstrel show held by the New York Aviator's Post of the American Legion. LEFT TO RIGHT, front row: Samuel Taylor Moore, Publicity Director, N. Y. Air Show; Mayor La Guardia of New York. REAR ROW: C. S. (Casey) Jones; Charles Mathews; John Roonan; Roland O'Brien; George R. Kent; Col. George A. Vaughn; Swanee Taylor; John C. Doyle.

when lust for power, gold and glory comes on a scene?

However, I'm straying from my point. What I wanted to report is the exhibition of colossal gall put up practically under the noses of the N. A. A. in session. After everything else failed, including all known variations on the "Co-operation!" theme, the Fordon-Brown team received a blunt warning that unless they "Co-operated!" by including some air races in their shows, the N. A. A., would see to it that they were run out of town in each city blessed with an N. A. A. chapter. I give you my word of honor the threat was made.

But, after all, it is to laugh. Fordon and Brown are far too up in the world for anything to come of this threat. One reason being that Bert Brown was for many years District Chief of the U. S. Secret Service and is thoroughly well versed in taking care of racketeers. And another excellent reason being the N. A. A. itself. This reputable organization is made up, in the main, of men and women who are deeply sincere and honest in their efforts to help the cause of aviation. And, I tell you, that vast membership will, at the first sign of skullduggery, toss out their contest committee just as quickly and neatly as the Air Races management ever tossed out a pilot or newspaperman seeking "Co-operation!" at the box office.

Yes, the clutch—tentacles?—is slipping. Although, the reason for this may be due more to managerial smugness, who said pampered greed?, than to any bloodless revolution on the part of the pilots.

Just Ducky . . .

Night flying ducks, believe it or not, are a new cause for concern by the Bureau and people using the airways in the Great Lakes district. There have already been several instances where they have flown into ships and, strangely enough, have in each instance struck the windshield with very messy results to the pilot (or co-pilot).

Both the Bureau and the manufacturers are trying to develop a duck-catcher for windshields which will toss the carcass aside and save the pilot the expense of sending his face to the dry cleaners.

More on this later.

Duckier Still . . .

My comments in the past about air hostesses have earned me the unenviable status of being unable to sip my broth aboard an air liner without wondering if arsenic really is tasteless. Nonetheless, let me recount still another incident which bears out my contention that females have no place in the operation of air liners.

During the last autumnal migration of wild fowl one of the west-bound Boeings out of Cleveland picked up a duck on the left windshield. Of course the pilot got a face full of bloody duck along with a lot of glass slivvers which punctured his features severely. So much so that he had to turn back to get medical attention.

Fortunately the little hostess of the sky didn't feel the ship making the turn so she

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Colonel Roscoe Turner Honored by N.B.C.

COLONEL ROSCOE TURNER, who has won all sorts of honors for his deeds in the air, has now received an award for his accomplishments on the air.

The famed speed pilot, who is now the star of the radio serial, Flying Time, has just received in behalf of the National Broadcasting Company, a scroll from Charles Horner, president of the National Aeronautical Association, "in recognition of the unique contribution to the advancement of American aviation through the medium of public education by radio with its program, "Flying Time."

The scroll was presented to Colonel Turner during the annual banquet of the association, held in the Blackstone Hotel, Chicago, Monday, November 30. A description of the program and the remarks of the speakers was broadcast over the networks of the National Broadcasting Company.

In accepting the scroll, Colonel Turner gave credit to William J. Murphy, well known young Chicago radio writer, who is author of the flying time scripts, and to two other men, Jules Herbuveaux of the NBC production staff, and Willis Cooper, former NBC continuity writer, who originated the program two years ago.

Murphy, according to Colonel Turner, receives the technical assistance of Herbuveaux in the preparation of all his scripts. Herbuveaux is not only an experienced radio production man, but in addition is a flyer of long experience.

Making the presentation of the scroll to Roscoe Turner.

Flying Time, starring Colonel Turner, is broadcast daily except Saturday and Sunday over the NBC-Red network at 5:45 p. m., CST., and is repeated for Western NBC listeners at 6:30 p. m., CST.

The radio program to be thus honored by the aviation industry was broadcast for the first time June 24, 1935. A list of fifty or more famous pilots and other prominent figures of the flying world who have appeared as guests on Flying Time would almost constitute aviation's Hall of Fame.

Merry Christmas at Rantoul in 1923

This is a reproduction of the tempting menu served at the U. S. Army Technical School, Chanute Field, Rantoul, Ill.

The NATIONAL AIR BOARD *Says*— *Unbiased Opinion to Further National Aeronautics*

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ALEXANDER KLEMIN, CHAIRMAN

AT the Seventh Meeting of the Air Board, Daniel Sayre, of editorial fame, represented Mr. Van Dusen, was a welcome newcomer and added many thoughts to the discussion.

A letter from C. S. (Casey) Jones brought the pleasing news that the recommendations of the Air Board regarding the forthcoming trans-Atlantic contest had been transmitted to the Racing Committee of the National Aeronautic Association and were receiving careful consideration.

IS THE DEPARTMENT OF COMMERCE SLOWING DOWN A TRIFLE?

There is no more devoted body of men in the United States than the local aviation inspectors of the Department of Commerce, none more anxious to cooperate with constructors or operators. But of late it appears difficult and inordinately slow to secure rulings from Washington on such minor matters as the installation of a new radio set in a recognized aircraft, and the paper work seems to be multiplying.

Are the Washington offices of the Air Commerce Bureau understaffed in relation to the increased volume of aviation activity, or is it simply a growth of the bureaucratic spirit in an organization which hitherto has been free from this terrible sin? The Air Board approached the subject tentatively and hesitatingly.

SHOULD AN AIRSHIP SERVICE BE SUBSIDIZED?

Representatives of the Department of Commerce, of the Navy Department and of the Business Advisory Council are busily considering plans for the subsidy of an airship service across the Atlantic. The system might be one closely resembling that provided for the merchant marine, with direct construction and operating subsidies based upon the differences between American and foreign costs.

The general plan would call for two dirigibles in regular trans-Atlantic service built and operated by Americans, but with schedules coordinated with those of Germany to provide frequent sailings in both directions.

In any gathering of aeronautically minded men, it is apparently sufficient just to mention the word airship to stir up a heated argument, and the Seventh Meeting of the Air Board was no exception, with lunch, parliamentary rules, time and all other considerations totally disregarded, and heated remarks the fashion of the moment:

"Terrible accidents to the Shenandoah, Akron and Macon! Hasn't the airship a definite speed limitation far inferior to that of the airplane? The Airship is a splendid airplane carrier and one airship is worth three cruisers in long range scouting. Were not the regular trips of the Hindenburg a marvel? How can the seaplane possibly compete with the airship in load carrying and non-stop operation across the ocean? Is not airship work always tied up with political consideration? A friend of mine gave a perfectly enthusiastic account of his trip across in the Hindenburg."

Such arguments have become almost classical, and need no further detailing, but after they had calmed down the members of the Air Board arrived at very definite and well reasoned conclusions:

1. National defense should be a paramount consideration, and neglect of the airship with possibilities of oceanic warfare would be a tremendous mistake.
2. Before Americans operate airships in commercial service, they should make absolutely certain they know how and American personnel should be given ample training.

Back in the good old days, this is the way engines were given a workout. This old-time photo shows Chanute field's discarded Jennies serving as test stands for the old Liberty engines.

3. It is indeed possible that stratosphere airplanes may in the distant future render airships obsolete. In the immediate future airships have the edge.
4. By all means subsidize. Surely aerial transportation is at least as worthy of help as the merchant marine.
5. But heavier-than-air craft have never received a subsidy properly so-called, and have a splendid record in transport work. What might not be done with a million dollar seaplane?

Therefore subsidize lighter-than-air, but in fairness give heavier-than-air precisely the same opportunities and help in regard to trans-Atlantic service.

HAVE WE ENOUGH AIRPLANES FOR NATIONAL DEFENSE?

At the Chicago meeting of the N. A. A. Major General Oscar Westover, Chief of the Army Air Corps, speaking guardedly as befits his position, hinted at a scarcity of American airplanes by comparing our own building program with that of other foreign powers. Arthur S. Dudley of the N. A. A. was more outspoken.

Now that the three thousand mile range bomber is here, the United States is no longer immune to aerial attack. Yet said Mr. Dudley,

"Our total airplane strength for July 1, 1936, was 1,329. We will receive during the next year about 500 additional planes. We hope to have a similar increase year by year."

"Let us see what foreign countries are doing," he said. "As of January 1, 1937, the military air force of France will total 4,400 craft; aircraft of Russia, ready for war, total 5,000; Germany, 2,800; Britain 1,790; Japan, 2,000 and Italy, 4,400. But this does not tell the story. Great Britain is expending in a twelve-month $80,000,000 in her own and American plants for military aircraft and engines.

"Germany is building 2,000 new planes; the fighters are armed with three twenty-millimeter cannons and six machine guns. The bombers are allotted one cannon and one machine gun and 1,000 pounds of bombs."

Members of the Air Board thought that the air defense situation was not entirely satisfactory. It is perfectly true that hostile attacks would have to come from overseas so that our forces may well be less than those of European countries. Nevertheless the Board came to this definite conclusion.

"Our total airplane strength for July 1, 1936, is not adequate for national defense."

There was no unanimity in regard to the number of airplanes which we should have available. Three thousand airplanes, perhaps a parity with France or Great Britain or something under parity, might be sufficient for our needs.

Another aspect of discussion was the precise reason why we had such comparatively few airplanes in service when our military and navy airplane budgets were now so generous. Is it because the process of designing and building an experimental plane is so retarded by the policies of the service that the interval between the conception of a new design and the production orders is something like three years?

Is it because our expenditures are higher for just the maintenance of the Air Corps as distinct from procurement of aircraft? Are we relying on superiority of prototypes and a vast building program when war actually threatens?

At the end of these exchanges of views, the Chairman was instructed to write to General Westover, put these questions before him and ask him to clarify the situation.

ARE WE BEGINNING TO LAG BEHIND EUROPE?

Incidental to the discussion on the number of airplanes needed for national defense, was the question whether the U. S. military airplanes were as good as those now being built in Europe. Some uneasiness may be indeed felt at the extraordinarily energetic efforts now being made in Europe. Rumors are current that thirty-five thousand men are being employed in a single German factory (probably a greater number than that employed in all the airplane manufacturing concerns in this country).

Rumors are also current of European bombers which have over three hundred miles an hour in speed. At a joint meeting of the A. S. M. E., I. Ae. S. and S. A. E., moving pictures were shown exhibiting the laboratories of France, Great Britain and Italy.

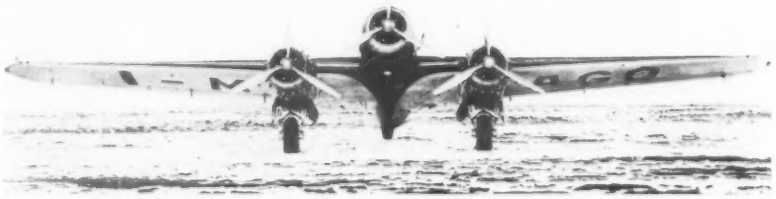
We have always nursed the notion that the experimental equipment at Langley Field, Wright Field and elsewhere put us well ahead of anything in Europe. Anyone who saw these films would not be quite so certain of our superiority in experimental research.

The aeronautical research laboratories now available at the D. V. L. (Deutsche Versuchsanstalt für Luftfahrt) are really overwhelming in their range and completeness. Italy has for the moment the only really practical supersonic wind tunnel in

(*Continued on page* 56)

ITALY'S AERIAL DEATH-DEALERS

This Caproni 133 utility bomber's three engines develop 1,360 H.P.



Savoia Marchetti's contribution is this S-79 long-range bomber . . .

. . . while this high-speed Fiat pursuit ship nets as protection.

Altitude and Your Health

by GEORGE MACK McKEOWN

Interesting facts relating to the effect of altitude upon the blood condition as determined by the noted physician Dr. Stanley G. Bandeen, who proves that air travel is "safe and healthful."

IF you have diabetes, don't be afraid to travel by air. Scientific research proclaims "that present day flight levels are entirely healthful, as well as invigorating."

That was the conclusion of Dr. Stanley G. Bandeen, nationally recognized Louisville, Kentucky, blood and gland specialist, following his recent returns from two trips by plane from the metropolis city of the Bluegrass State to Eastern cities. Dr. Bandeen doesn't have diabetes, not does he suffer from any similar ailment, but he had made blood tests while flying in airline system ships to determine the effects of high altitudes on the blood, thus clearing up the question of whether air travel is harmful to those suffering blood diseases.

For experimental purposes and all for the sake of science and those people who have been hesitant about taking up a career "in the clouds," Doctor Bandeen used samples of his own blood which he had taken from himself on the two separate flights he made.

Science has already proved, Doctor Bandeen explained, that blood in the human body reacts to pressures just as a weather barometer does. During a storm period, when the barometric pressure is exceedingly low, the blood contains more milligrams of sugar than in clear weather. Such an event as a thunder-storm is known to have raised the sugar content in a person's blood as much as 45 milligrams. Such a change as this, made suddenly, might easily cause dizzy spells or a partial loss of equilibrium.

Considering this, many people have been of the opinion that flying in airplanes at high altitudes would cause a decrease in oxygen content in their blood, thus bringing about physical ills and disorders.

The complete question seemed to be—"Whether or not the barometric pressure of high altitudes was sufficient to cause the blood to become deficient of proper oxygen and cause any undue physical stress, either while in the air or afterward, to those already suffering blood disorders?"

Doctor Bandeen pondered over the query for a long time, before he decided it was time to act. Many of his patients had resigned themselves to land travel, even though many were desirous of taking advantage of the many features offered by air travel systems. One young man patient of Doctor Bandeen's went so far as to forfeit a career as an air pilot for a large corporation, turning "thumbs down" to the lucrative offer, believing all the while that such an occupation would be certain to bring back the many anguishes of a diabetic ailment of years gone by.

Doctor Bandeen is a booster of aviation, making trips by air whenever the opportunity arises, and to see and hear these "beliefs" caused him no little concern. Finally he reasoned that the only way to answer these "beliefs" satisfactorily was to make trips by air, taking blood extractions along the routes at varying altitudes.

American Airlines' officials, learning of his intentions, offered the assistance of their stewardesses, all of whom are registered nurses. This was a great relief to Bandeen, as he had anticipated a general "kick" from airline operators, thinking they might fear that the outcome would be "against" their form of transportation, causing a decrease in passenger business. But instead, they worked side-by-side with him, ready and eager to prove their mode of travel as harmless as any of the "streamline era."

Stewardess Mabel Harmon makes a blood extraction from the arm of Dr. Bandeen, Louisville, Ky., blood specialist.

The "blood saviour" decided to make two trips, making experiments on both so that a comparison could be made. He made his first extractions on a trip from Camden, New Jersey, to Louisville, via Washington, D. C. He drew first blood at the Camden airport, which is situated at about sea-level. His vital fluid, as later tests showed, contained 76 milligrams of sugar. His next test, taken at 2,000 feet, one-half hour later, showed his blood contained 78 milligrams of sugar, while at the Washington airport, Bolling Field, which has practically the same sea-level as Camden, his blood again registered 76 milligrams.

Two hours later, flying high above the beautiful Allegheny Mountains of Pennsylvania at 6,000 feet, his blood milligrams increased to 90. The increase was not startling, considering that the blood in some instances scales 30 milligrams in one-half hour after two teaspoonfuls of granulated sugar have been consumed. The next extraction was made at Bowman Field, Louisville, which is 540 feet above sea-level and this test showed his blood to contain 77 milligrams of sugar. His second air trip was made from Louisville to Cleveland, Ohio, and the results of this trip were less startling than those of his initial "hypodermic hop."

These tests seem to give a satisfactory answer to the old question of air-pressure and altitude effect upon blood composition with particular reference to diabetic conditions. There have been many articles published upon the danger of air travel in the case of diabetic patients but, so far as known, these articles were based upon conjecture rather than solid experimental evidence.

If more such studies were made basic, the research upon various human distress signals, it is to be believed that there would be less difficulty in getting people to try that "first ride".

Doctor Bandeen not only "gave of his own blood," but also made his own analysis in his modern laboratory, witnessed by a group of prominent blood specialists from all parts of the nation. During the entire procedure of each flight and four to six hours prior, Doctor Bandeen deprived himself of food and drink, thus unfounding any claim that it was not the altitudes that brought about the milligram fluctuation.

"My experiments seem to indicate that the thought of air travel being harmful to sufferers of blood diseases is wholly without basis," the physician said. "Since the Bureau of Air Navigation, of the Department of Commerce, prohibits commercial air travel at higher than a 15,000-foot level, I would say that the present flight levels are entirely healthful, as well as invigorating."

"Chronic sufferers of diabetes and similar ailments should be taught, through scientific research, that an airplane ride is no more harmful than a sojourn in a horse-drawn surrey," exclaimed Doctor Bandeen.

When asked about his version, from a medical standpoint, of trans-oceanic flights, which require days in the air instead of hours and on which much flying is done at exceedingly high "tops," he merely proclaimed, "Until the day of stratospheric flying I will not make further tests as I believe those I have just completed are conclusive enough to absolve not only our present national airline systems, but also those which span the Pacific and Atlantic oceans. As far as blood conditions are concerned there is certainly no cause for alarm."

END.

XUM

The French Air Meet Is Exciting

THE International Air Meet at Saint-Germain, one of the annual Fêtes de Paris, was a beautiful demonstration of plain and fancy flying. There were no high speed races or gilded trophies, nor even any formation flying, but superlative individual skill and daring at their best.

Incidentally, if some of our race promoters who think "pylon polishing" is the only way to draw a crowd, could have seen those 300,000 spectators (Pathé News estimate, JBR, not ours) massed about that field they would have been green with envy. Even allowing for the difference in the French temperament and the fact that there were no regulations against any kind of flying, they might have picked up a few ideas about how to stage a financially successful show.

In the first place, a demonstration of acrobatic flying can be confined to a comparatively small area. Then, to insure the gate receipts, the canny French picked out a field in the middle of a dense forest, which not only concentrated the customers on the edges of the field, but by the very nature of the hazard, added zest to the spectacular performance of the flyers. A 2000 foot runway may be duck soup in the wide open spaces, but dropping 600 horses down into the center of a forest glade is a different story.

It was not the time or the place for amateurs. Only the most famous pilots of France were chosen to pit their skill against Milo Burcham and Joseph Mackey, who upheld the honors for America.

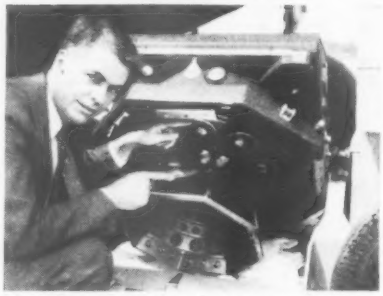
Against the cloud-flecked sky and to the symphony of roaring motors, whining struts and the whistle of tortured wires, the trim ships were put through every maneuver known to bird or man, while the perspiring thousands, overflowing the grandstands, clinging to the fences and perched in the surrounding tree tops alternately gasped and cheered.

Burcham, holder of the world's record for upside-down flying, and his snub-nosed little Boeing came in for a lion's share of the applause. Inverted loops, whip-stalls, power dives—right side up or upside-down—it was all the same to the blue-eyed Californian. Any stunt the French aces had to offer, nonchalantly he repeated all of them again and again, *upside-down!*

An audible gasp swept through the stands every time the red Boeing flipped over, and shooting toward the field in an inverted power-dive, flashed across the airport with the pilot's head only a few feet off the ground. And when the stubby little ship zoomed straight up until the motor stalled, fell off into a vertical side-slip and swished in for a perfect landing, it was greeted by frenzied cheers, led by a queer piercing call over the loud-speakers, "peep-peep, peep-peep, peep-peep-peep," which seems

(*Concluded on page 57*)

New Army Camera



Here's the new Army camera.

THE newest in aerial cameras, hailed as an innovation that will revolutionize aerial mapping technique, is being installed in the bomb bay of a twin-engine Martin bomber at Wright Field for test by the army to determine its military usefulness.

Conceived by and built under direction of Lieut. O. S. Reading, with funds of the coast and geodetic survey of the department of commerce, the instrument is unique in that only one of the nine lenses takes pictures direct—the other eight lenses photograph "second-hand," each through a polished steel mirror reflecting roughly one-eighth of the camera's horizon.

One lens in the very center covers the terrain directly beneath the airplane. The other lenses are spaced at equal distance around the outside of a cone, which is paneled by the eight mirrors. The cone is like a deep socket, of which the center lens would be the eye.

This arrangement permits placing the lens in one geometric plane, and the nine simultaneous exposures are all caught on one piece of film, 24 inches square. When the perspective, or obliquity, is corrected in the special printer that has been built, the composite octagonal 35-square-inch photograph may include 600 square miles, depending on altitude.

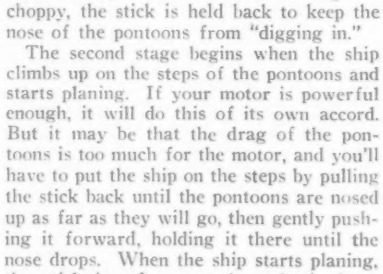
An essential feature is the automatic shutter tripping device. The operator, peering through the range finder, adjusts the speed of a belt passing fine lines across the lens. His purpose is to time the belt speed so the fine lines appear "glued" to the view below. The rest is automatic, for the belt is connected to the shutter and trips it just as each photographed area is cleared.

Handling a Light Seaplane

by MANLY MILLS

IN taking off from calm water, the stick is held in neutral during the first stage of the take-off, but if the water is rough or choppy, the stick is held back to keep the nose of the pontoons from "digging in."

The second stage begins when the ship climbs up on the steps of the pontoons and starts planing. If your motor is powerful enough, it will do this of its own accord. But it may be that the drag of the pontoons is too much for the motor, and you'll have to put the ship on the steps by pulling the stick back until the pontoons are nosed up as far as they will go, then gently pushing it forward, holding it there until the nose drops. When the ship starts planing, the stick is, of course, brought back to neutral. The dropping of the nose and increased speed will indicate when the ship is planing.



This new aluminum sea-anchor assists seaplanes.

If the stick is held forward too long, the plane will start rocking violently back and forth, or "porpoising." You should not try to stop this by moving the stick back and forth sharply, but simply bring it gently back to neutral and hold it there. If you pull it back too quickly or too far, the ship may jump out of the water and strike with a sharp splash that is not so comfortable and easy on the pontoons.

If the ship seems reluctant to get up on the step, you might try rocking it gently, never pulling the stick back much further than neutral. Then again, working the ailerons or rudder slightly may help to break up any suction behind the steps.

A fact not generally recognized, though perfectly obvious, is that the seaplane will start planing much easier in shallow water, about two or three times the draft of the pontoons. As the ship runs over the surface, the water displaced by the pontoons can't escape but "piles up" under the pontoons, lifting them up on the steps even when other methods don't work.

After the machine starts planing, there is little to do except steer a straight course and let the ship gain enough speed to lift off the water. If the water is smooth and glassy, the pontoons may have difficulty in breaking away from the surface, in which case you will have to pull back on the stick to bring the ship off.

Take-offs are usually easier and quicker in water that is slightly choppy. The danger of stalling in a seaplane on account of a premature take-off is not so great because considerable speed is necessary to overcome the friction of the pontoons.

(*Concluded on page 58*)

Stress Analysis Made Painless

by

RAOUL J. HOFFMAN

Aeronautical Engineer and Designer

FITTINGS are compact units employed for transferring stresses from one member to another, usually through assembly with bolts, pins, or rivets.

Directly welded parts in primary structure do not constitute a fitting. Their design and manufacture involve a great deal of time and labor, therefore, a thorough knowledge of loads, stresses, material, manufacturing facilities available, manufacturing methods and number of airplanes to be built will be extremely helpful.

The lower the strength weight ratio and cost, the more efficient will be the fitting obtained. A quick decision as to whether they be welded, brazed, riveted, stamped, forged, cast or bench-filed and how many parts shall be used to make the fitting is necessary of a good designer.

And surprisingly, though this experience is expected of a good designer, the novice is the one usually put to designing fittings (shop or office).

The U. S. Dept. of Commerce has prepared certain requirements for fittings based on the present development of safe design. It requires that they should be designed to carry loads 20 percent. in excess of the loads in the members to which they are connected, or that receive their critical loads. In fittings made up of several parts welded together, proper allowance for the effects of welding must be made.

Special care should be taken of forces introduced by the attachments of fittings to the structure and, if possible, eliminate eccentricity of loads, torsional and bending stresses. A strength test may be required in cases where stress analysis methods appear inadequate.

Only aircraft bolts should be used in the primary structure and the allowable bearing load assumed for the threaded portion of a bolt shall not exceed 25 percent. of the shear strength of the bolt. Eyebolts subjected to bending shall have a radius of at least a quarter of the diameter of the shank, between the head and the shank.

The minimum size of tie-rods in a primary structure is No. 13 (.072"). Fittings attached to cables or wires up to and including the 3400-pound size shall have at least the same rated strength as the wires and cables.

Brazing and spotwelding are not permitted on assemblies constituting parts of the primary structure, except in certain cases, such as attaching pin-plates to increase the bearing value of lugs.

The use of wood screws is prohibited for carrying structural loads. Bolts smaller than the ¼"-28 size should not be used to bear in wood in the primary structure, and the use of hollow bolts should be avoided as they may throw the load towards the outer portion of the bolt. Fittings should have adequate protective covering.

The loads imposed on a fitting can be obtained from the stress analysis, the direction and the angle of the forces from the general assembly drawing. To prevent eccentricities the lines of all forces should meet at the neutral axis and in case this can not be met, the eccentric force introduces new loads on the structure and a new stress analysis must be made.

The dimension of the cross-section of a fitting is based on the unit stress, or the force per unit area of surface, and the load acting through the center of gravity of the

~ PROPERTIES OF AIRPLANE MATERIAL ~

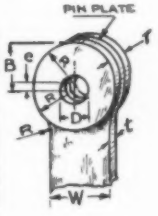
-STRENGTH TO BE GUARANTEED BY MANUFACTURER-

MATERIAL	SPEC.	ULT'E TENSILE STRENGTH	YIELD POINT	MODULUS OF RUPTURE	SHEAR STRENGTH	COMPRESSION PARALLEL TO GRAIN	COMPRESSION VERTICAL TO GRAIN	MODULUS OF ELASTICITY IN MILLIONS	WEIGHT PER CU. FT.	NOTES
SPRUCE	15% MOISTURE	10,000		9400	750	5000	720	1.3	27	
ASH	"	16,000		14,800	1380	7000	1920	1.46	41	
BIRCH	"	17.000		15,500	1300	7300	1300	1.78	44	
BALSA	"	4000		3000	200	2200	100	2.00	(4-20) 9	
PLYWOOD-SPRUCE	"		5600	~	1280	7600		1.4	27	5PLY-/90°
" BIRCH	"		13,200	~	2200	1600		2.25	42	3PLY/90°
COM'L STEEL	SAE 1015-1020	42,000	27,000		25,000	65,000		28	490	
MILD CARBON	1025	55,000	36,000		35,000	90,000		28		
CHROME-MOLY	4130	95,000	60,000		60,000	140,000		29		
3½% NICKEL-H.T.	2330	125,000	105,000		80,000	175,000		29		
CHROME NICKEL: 5-1	3130									
" " ~1-2	3240	150,000	125,000		100,000	190,000		29		
CHROME-MOLYBDENUM	4130									
	1623	180,000	150,000		115,000	200,000		29		
CHR VANADIUM	6130									
CHROME-NICKEL (18-8)		80,000-200,000								STAINLESS STEEL
SOFT SOLDER					3000					
SILVER SOLDER					10,000					
ALUMINUM (SHEET)		30,000	20,000		30,000			8	165	
ALUMINUM ALLOY		55,000	30,000		30,000	75,000	~	10	175	
COPPER HARD ROLLED		50,000	25,000		30,000		~	17	550	
BRONZE (TOBIN)		120,000	75,000		35,000	70,000	~	12	567	FORGED
BRASS YELLOW HARD ROLLED		70,000	45,000		36,000			13	524	
WELDING STANDARD W. ROD			30,000		30,000					ALLOWABLE
BRAZING					20,000					
GLUE ANIMAL ~		4000			3000					NOT RECOMMENDED
" CASEIN ~		4000			3000					150-250 PRESSURE
CELLULOID			10,000			20,000	~		90	
RUBBER			1100			1000	~		54	

MOST PART of ABOVE SPECIFICATIONS CONFORMS TO ARMY AND NAVY STANDARDS.
NOTE: THE LAST TWO FIGURES IN THE SAE STEEL NO. MEANS CARBON CONTENTS
~ IN 1025 ~ 25 MEANS .25% CARBON ~

~ DIMENSIONS FOR LUGS ~
~ FOR MILD STEEL ~

RATED STRENGTH	D	e	R	B	T	WIDTH of SHANK W: t=1/32	1/20	1/16	3/32	1/8	3/16	1/4	5/16	3/8
1100	3/16	3/64	7/32	17/64	3/32	3/4	1/2	3/8	1/4					
2100	3/16	1/16	9/32	11/32	1/8	1 7/16	15/16	3/4	1/2	3/8				
3400	1/4	1/16	11/32	13/32	3/16	2 5/16	1 7/16	1 3/16	13/16	5/8	7/16			
4600	5/16	3/32	7/16	17/32	3/16		1 15/16	1 9/16	1 1/16	13/16	9/16			
6100	3/8	9/64	9/16	45/64	3/16		2 9/16	2 1/16	1 3/8	1 1/16	3/4			
8000	3/8	9/64	9/16	45/64	1/4			2 7/8	1 15/16	1 7/16	1	3/4		
12,500	7/16	5/32	21/32	13/16	5/16				2 13/16	2 1/8	1 1/16	1 1/16	7/8	
17,500	1/2	3/16	3/4	15/16	3/8					2 3/8	1 3/4	1 5/16	1 1/16	7/8

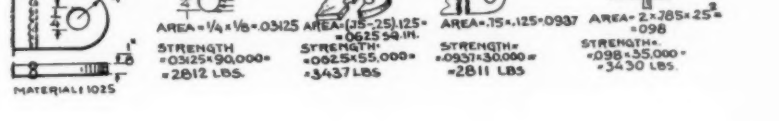


~TIE-RODS~

No of WIRE + No. of TH'D P. IN.	6-40	10-32	1/4-28	5/16-24	3/8-24	7/16-20	1/2-20
RATED STRENGTH	1000	2100	3400	6100	8000	11,500	15,500

~STRENGTH of HARD WIRE for AIRCRAFT~

B&S GAUGE NUMBERS	13	12	11	10	9	8	7	6	5	4
BREAKING STRENGTH	1100	1300	1600	2000	2450	3000	3600	4550	5450	6650
DESIGN STRENGTH-WIRE with TERMINAL	950	1150	1400	1650	2100	2550	3100	3850	4700	5750


EXAMPLE:
3/4
1"
MATERIAL: 1025
BEARING (COMPRESSION)
AREA = 1/4 × 1/8 = .03125
STRENGTH = .03125 × 90,000 = 2812 LBS.
TENSION
AREA = (.35-.25) .125 = .0625 SQ. IN.
STRENGTH = .0625 × 55,000 = 3437 LBS
TENSION (WELD)
AREA = .75 × .125 = .0937
STRENGTH = .0937 × 30,000 = 2811 LBS
SHEAR (DOUBLE)
AREA = 2 × .785 × .25² = .098
STRENGTH = .098 × 55,000 = 3430 LBS.

section. Uniformly distributed stress is found as follows:

Stress in lbs./sq. in. = Load/Area of section in sq. in.

The three basic stresses characteristic to materials are, tension, compression (bearing), and shear. There is no pure stress in one direction possible; usually the material fails in shear. The denomination of the stresses indicates the direction of the load in regard to the cross-sectional area.

A tabulation of the strength properties of material used in aircraft design is shown accompanying this article; it is for the most part based on material conforming to Army and Navy Specifications and it is given solely for the information to the designer as to what can be expected from material of a quality satisfactory for use in aircraft constructions.

A main property of material constitutes the elastic limit, which is the limit of the stress within which the deformation completely disappears after removal of the stress, then we have the commercial elastic limit or yield point where sudden and large increase of deformation (elongation) occurs without increase of stress.

The modulus of elasticity indicates the load necessary to elongate a bar of the material to twice its length assuming it has the same deformation qualities as it has within its elastic limits. The modulus of elasticity, denoted by the letter "E," is used in calculation of deformation, deflection, and loads possible on struts.

A numerical example shown on the chart will demonstrate the application of a strength estimate of a fitting. All calculations are based on the cross-sectional area, and in case there are rivets, pins, or bolts used, the area considered is not the contact area of the cylindrical section, but the diameter of the closely fitted hole times the width of the material in contact; very often a large tolerance used for mass production reduces the contact area considerably.

When designing fittings additional characteristic details have to be considered, such as, resonance to vibration, quick replacement if repair is required, prevention of moisture collection, electrolytic action of differing materials, prevention of parts lost in disassembling, and, if possible, enclosure within the structure to reduce air resistance.

Templates made of cardboard or sheet metal, clay models, or fittings made of celluloid to be tested in polarized light will aid the designer as well as the experimenter to improve the efficiency of a fitting.

In a following issue we will show sketches of fittings showing application of various manufacturing facilities, sketches of good fittings and sketches of fittings which have failed in service.

It has been the habit, ever since the inception of aviation to skimp on the fittings and then to give an unnecessary amount of attention to the design of the major members of the airplane. In short, we frequently encountered conditions where the connections and fittings were so weak that they could not even approach the strength of the members that they connected and, therefore, a total failure took place. It is my purpose to show how necessary such fittings are and how they can be computed.

First Douglas DC-3's Used by United

Head-on view of the Douglas DC-3 showing the details of the Venturi type housings on the motor nacelles.

JUST before we went to press with this issue, a New Douglas DC-3 belonging to United Air Lines, made its first appearance at the Municipal Airport, Chicago.

This latest Douglas carries 21-passengers and a crew of three. She is first of 30 such liners to be purchased by United and its gigantic size can be seen below.

The DC-3 carries two 1,000 h.p. engines enclosed in a new Venturi type cowl and shows a top speed of 212 m.p.h. She cruises at 194 m.p.h. at 75-percent throttle.

The side elevation of the Douglas DC-3 shows the same general layout as the DC-2.

Production Started on Hammond "Y's"

MARKING the formal opening of the new Stearman-Hammond Aircraft Corporation factory, South San Francisco, California, an open-house was held by the company on Sunday November 22. Over 1,500 called to inspect the new building and the factory's facilities.

Over 25,000 square feet are devoted to assembly line, store-room, heating plant, paint rooms, etc. The executive offices are housed in a one-story extremely modern building that fronts the entire width of the factory which includes offices for executives and subordinates, designing and engineering departments.

The factory is admirably located for transportation facilities and climate as well as for metropolitan sources, for raw materials and equipment. It is about 11 miles south of San Francisco on U. S. Highway 101 about one-half a mile north of the San Francisco Municipal Airport, which is the dispatching point for coastwise as well as transcontinental airlines, and being prepared as the home base for the Pan-American Trans-Pacific Lines.

Operations are already started. Small parts are being made and heavy equipment is gradually being set into place. In the latter category are, head-treating furnaces, compressors and other heavy equipment. Delivery of engines is already started, and it is expected the first ship will be completed within a month—and that ships for public purchase should be available sometime after the first of March.

Estimating the Velocity of Planes

by WILLIS L. NYE

The author gives a simple method of estimating the velocity of airplanes that requires only a knowledge of elementary mathematics. It is notable for its simplicity.

THE knowledge of estimating the horizontal velocity in miles per hour in hypothetical airplane design is the first step in determining the performance in its various categories.

There is nothing complicated in the close estimation of the horizontal speed at sea-level. The methods enumerated here are used to determine the speed at sea-level air density. The altitude is considered at zero. If the speed at any other altitude is desired, I also give an approximate way of figuring this with consideration for the lighter density of the air.

Maximum horizontal speed may be defined as the condition of flight where the drag in every one of its forms, parasitic, induced, skin friction, interference, and profile drag is at the bedrock minimum. When this condition is satisfied, the propeller thrust is at maximum. The H.P. available applied to the propeller is at maximum efficiency and the best ratio of the V/ND accrues to a high value enabling maximum speed.

For an accurate estimate of speed, the propeller efficiency must be accounted and reckoned with in the estimate. The curve shown in Figure 1 has been developed by Lt. W. S. Diehl of the U. S. Navy. It is known as the general efficiency curve for propellers. This curve has been determined by laboratory experimental propeller tests.

The highest maximum velocity of the airplane occurs where the ratio of the thrust A.P. available to the thrust H.P. required for level flight is at maximum. Under ordinary conditions propeller efficiency will vary from 75 percent to 85 percent. In no case should the tip speed exceed 1000 feet per second. Beyond this figure there is a serious drop in the V/ND ratio.

The propeller diameter chosen can be determined for good performance by the tip speed velocity. In estimating the V/ND ratio, the velocity of the plane should be figured in feet per second, the revolutions in revs per second, and the diameter in feet. In the formula V/ND, V stands for the velocity in f.p.s., N is the revs per second, D is the diameter in feet.

To begin to determine the performance characteristics, the maximum horizontal velocity is usually found first. This is done in order to determine the best propeller for the supposed airplane design. Now this sounds like placing the cart before the horse.

When this is done, however, a propeller diameter can be so determined that a high ratio of V/ND can be achieved. The higher the speed the better the V/ND ratio. Now this propeller will not be the best propeller diameter for anything except for speed. It will be less efficient for climb and not the best all round performance propeller.

The propeller efficiency should always be assumed as being about 80 percent in most calculations. Some formulas for speed require the propeller efficiency be included. Others delete that factor. There are four commonly accepted ways of estimating the high speed which is the most important quantity in airplane performance estimation.

The method developed by Mr. Edward P. Warner, author of the publications, "AERODYNAMICS" and the "AVIATION HANDBOOK," is as follows. This formula makes use of a "K" value multiplied by the cube root of the total engine power, divided by the wing area in square feet. In mathematical form it is usually given thus:

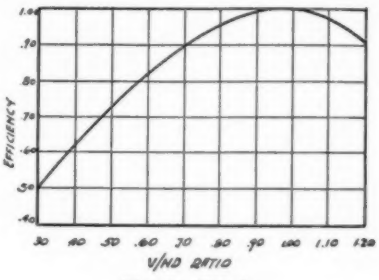


Fig. 1. Graph.

$$K \sqrt[3]{\frac{\text{Power}}{\text{Area}}} \quad \text{or} \quad K \sqrt[2]{\text{Power to Surface}}$$

The factor "K" is a coefficient determined experimentally for a number of planes of known performance. It is based on the ratio of several quantities of profile, induced, parasitic, and interference drag to the total wing area.

By reference to the following table the established "K" value for a number of planes estimated by Mr. E. P. Warner is given. By referring to this table, the determination of the "K" value of a contemplated design may be determined. In using the power in this formula this is the power developed by the engine at sea level. The "K" value for a number of modern planes is here given.

$$K = \frac{175.9}{1.279\,\overline{)\,225.000}}$$

1279

9710
8953

7570
6395

11750
11511

For the Northrop Gamma the K value can be determined as 175.9 or 176. When the speed, the area and the H.P. are known, the K value can be estimated. To find the cube root refer to a handbook of mathematical tables.

The formula promulgated by Lt. W. S. Diehl makes use of the stalling speed of the plane as the basis and the propeller efficiency. This formula will be very accurate in the estimation of the high speed.

$$\frac{\left(\frac{L}{D} \times Nm\right)^{1/3}}{\left(Vs \times \frac{W}{HP}\right)^{1/3}} \frac{Vm}{VS} = \frac{K}{}$$

Vm: Maximum speed.
Vs: Stalling speed.
L/D: Maximum Overall Lift to Drag Ratio.
Nm: Maximum propeller efficiency.
K: 10.2
Average Value of K

$$\left(\frac{L}{D} \times Nm\right)^{1/3} = 19 \text{ to } 20$$

The exponent ⅓ is the same as taking the cube root of the quantity. The answer to the formula above will be the ratio of the high speed to the stalling speed. It is essential to estimate the stalling speed in using this formula first, and then to multiply the stalling speed by the answer to the formula above. This will be the high speed.

Stalling Speed: $\sqrt{\frac{W}{S}}$ 19.77

CLmax

TABLE I

Plane	Vmax	W/S	P/S	K
Curtiss Army Racer	224	15.16	3.31	150
Verville Sperry	192	14.82	2.66	138
Curtiss NCR3	246	19.10	4.36	150
Curtiss RC3	264		4.20	164
Macchi M39	261	22.80	5.65	147
S5 Supermarine	308	28.20	7.57	157
Gloster IV	307	24.60	7.08	159
S6B Supermarine	408	40.70	18.30	154
Laird Super-Sol.	268	22.15	4.74	160
G-B Super Sportster	294		8.34	145
Wedell Williams	277		5.01	161
Monocoupe	145	12.30	8.34	151
Fleetster	185	17.80	1.85	147
Orion	200	18.70	11.50	161

W: Weight S: Area P: H.P.

XUM

The stalling speed may be figured by the above formula.

Another method of estimating the speed is to compute the same on a basis of the wing and the power loading. This has been given in POPULAR AVIATION several times.

TABLE II

P/S (Cube root of Wing Power Loading)	Possible Speed
2	195
3	224
4	242
5	260
6	270
7	280
8	285
9	290
10	303

The above curve for the speeds figures approximately a straight line when plotted against the logarithmic scale of the cube root of the wing loading. The logarithmic scale is on the vertical side of the graph and the speed is on the lower edge of the graph graduated in ten mile per hour divisions.

The logarithmic divisions can be laid out by taking the major divisions on the slide rule and marking the same proportions on the vertical edge of the graph. The speeds of known approved plane performances are plotted and an average straight line drawn through the center. This method is fairly accurate for a rapid determination as to what the high speed will be.

To figure the speed at altitude find the density value of the air to that at sea level. The speed at the desired altitude will be $\frac{1}{\sqrt[2]{\text{density}}}$ times that of sea level, provided the H.P. remains the same. However the H.P. drops as the altitude is increased.

TABLE III

Density in %	Altitude	Engine Power Constant Revs.
95	2000	95%
90	4000	87%
85	6000	80%
80	8000	75%
75	10000	68%
70	12000	62%
65	14000	58%

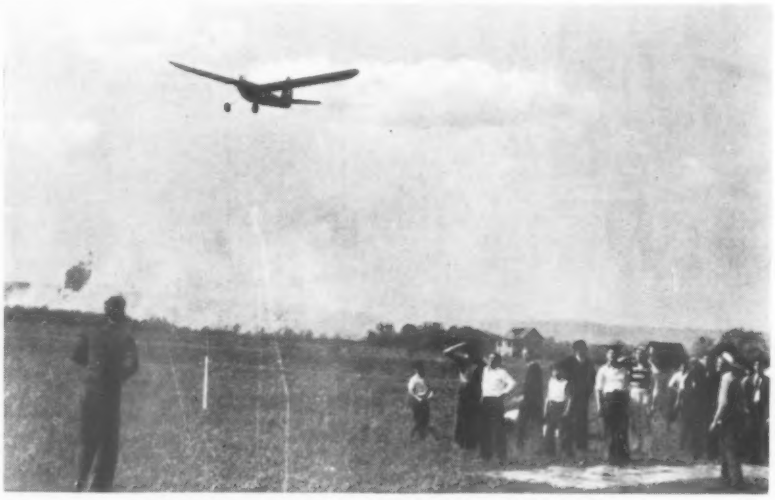
To find speed at any altitude use formula $K\sqrt[2]{\frac{P}{S}}$. Take the corresponding engine power equivalent for the altitude. Take the answer to the above and multiply by the reciprocal of density or $\frac{1}{\sqrt[2]{\text{density}}}$

The latest and the best way of figuring the high speed has been recently published by the N.A.C.A. This method makes use of the ratio of the value of the parasitic loading per square foot of wing area to the effective thrust H.P. loading. By figuring this ratio the speed may be reasonably and quickly estimated.

For the benefit of the lightplane fan, the tables of cube roots of decimals are here

(Concluded on page 60)

A Few Gas Model Snapshots at Random



The modified Cavalier of Fred Willis takes to the Air.

ON these wintry days it does one good to look back to the pleasures of the good old summer time, particularly when we reflect on the gas model activity of last fall and summer.

The large picture at the top shows the beginning of a fine flight, the take-off of the modified Cavalier owned by Fred Willis of the Kresge Club, Newark, N. J. History doth not say just what took place immediately after this fine start. It is powered with a Brown, Jr., engine.

And then we have our friend Paul W. Lindberg, Chicago, starting a fine flight with his standard Rearwin job. The attitude Paul shows would gain him an entrance in any ballet as a springtime classical dancer. But just the same the Rearwin flies and flies after its personally escorted takeoff.

Paul Lindberg flies his famous Rearwin.

Building Models for the Market

HAVE you ever built model airplanes for profit?

It is simple for the experienced model builder. Although the modelist will not become rich over night, it provides a fairly good source of income for pocket money or for carrying out your own model activities.

The most important thing to remember in making planes to sell is, that you must make what the customer wants, not what it is interesting to build. To the model builder, nothing can surpass a well constructed endurance plane, but to the average person the endurance plane looks like nothing more than a collection of disconnected parts. I know from experience that the models a man buys for his mantel wouldn't stand the ghost of a chance in a model airplane contest. Most customers want something that looks good in their home.

The scale model then would seem the choice of the customer. The Lockheed ships, the Boeing Air Liner, Douglas Monoplanes, and most World War planes are good ones to build. The modern ships owe their popularity to the great beauty of their streamlines while the Wartime planes are usually colorful and rich in detail.

Right here I want to warn about using too much detail. When I first started building models, I put as many details on the planes as possible. A machine gun had to have sights, trigger, and all the trimmings. Ditto the rest of the ship. When the ship was completed, it looked like a complete mess, and the beauty of the construction was ruined by cluttering it all up. It is difficult to tell how far to go with detail. Let me show an example:

A model builder in Toledo made a nice model of a popular transport plane and even went so far as to put pistons in the

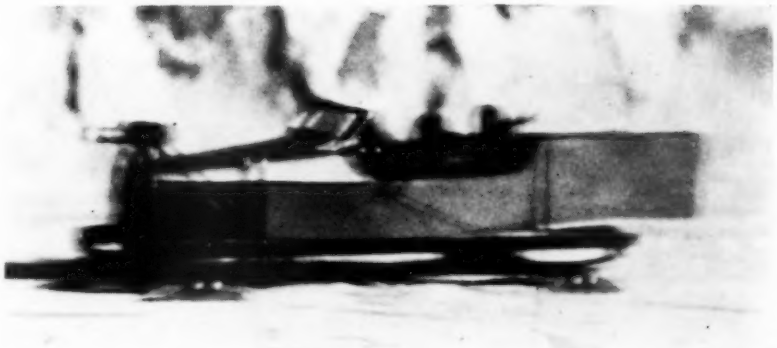
(Concluded on page 68)

A Ford Powered Aero-Sled

by DICK COLE
PART I

MR. COLE has presented a most interesting and useful home-built aero-sled construction series of which the following is the introduction.

Fellows living in the northern states and living near a river will find the aero-sled one of the best paying investments they have ever made both for business and pleasure.



Here's the Aero-Sled that presents a good appearance in addition to having a good performance, an unusual combination in the majority of home-built winter wind wagons.

ONE hundred miles an hour!

This thrilling speed is attainable with the novel ice vehicle described in this article, and the building of it is wholly within the scope of the pocket-book and the ability of the home mechanic with reasonable workshop facilities.

The chassis of a "light car" is the chief requisite to the construction. An old "Model T" Ford, while it can be converted into an aero-sled, is not recommended. A car with semi-elliptic springs and sliding gear transmission lends itself more readily to the reconstruction. The motor of the chassis should be in good condition.

The drawings and a complete description of this sled will be given in succeeding issues of POPULAR AVIATION and will cover the entire series of operations in a most comprehensive manner. Anyone handy with tools can build it.

The plan and elevations show the construction of the aero-sled in a general way. The prospective builder will be intrigued by the sheer novelty of the craft. As he goes over the individual points of construction he will be impressed with the practicability, simplicity, and safety element of the vehicle.

The outstanding features are: the radical streamlining which makes the high speed possible with the minimum power; the simplicity of the propeller drive by multiple V belts from a pulley integral with the motor fly-wheel; the aero-brake which quickly brings the sled from breath-taking speed down to 30-35 miles an hour, after which the friction brake is effective; the simple tubular radiator around the nose. Other novel features will come to light later.

A second sheet of drawings covers the construction of the chassis frame. One may wonder why the original auto frame is not used in the reconstruction. The fact of the matter is that the original car frame is needlessly heavy for the aero-sled; it is too short to permit effective streamlining; the usual "hump" over the rear axle would interfere with the aero-brake; the frame cross-members would interfere when turning the motor about with the fly-wheel end to the front of the chassis. So, all in all, it is easier and more workmanlike to build up a new chassis frame.

The main rails are laminated from three lengths of clear spruce or ash: 5/8" x 4" x 144". Strips of 18 or 20 gauge sheet iron are placed between the layers of wood, and the whole is glued up with water-proof glue, and nailed together with 2" staggered at 3" intervals.

These wood and metal laminated rails have amazing strength for their weight, and will not develop a sag with age. The cross-members of the frame, the end posts, and the motor bed rails are of 2" x 4" clear pine stock. Angle-plates and brackets contribute added strength where needed.

Obviously, few fixed dimensions can be given, as these vary slightly according to the original auto chassis used. The width of the frame must be the same as the width between the original front springs, and the motor cradle must be made to conform to the supports of the particular motor used. The posts, the bulkheads, and the seat-backs can be built up true to the given dimensions.

A drawing in perspective shows the general assembly of the built-up frame. The builder can readily see how this framework can be covered with sheet metal, iron or aluminum. Or it might even be covered with strong muslin and be treated with airplane dope. The top of the motor hood is removable to give ready access to the motor.

In the third drawing, we take up the construction of the runners, axles, and friction brakes. The body of the runners is of white maple the same thickness as the spokes of the original auto wheels, from 1½" to 2". The four runners can be band-sawed from a board of correct thickness 6" x 120". The semi-circular top-piece is cut separately and held with a 3/16" iron band and lag-screws.

And so, in our next issue, we will start the series of drawings and the full description of the construction. The Aero-Sled is easy to build, but it should be built carefully and with full attention to detail.

(To be continued next month)

Meet Mr. Cole, author of this article, at work in his unusually complete and well arranged home workshop.

XUM

Model Gasoline Motor Notes

by

JOSEPH A. NEIGEL

Pioneer gas model designer and builder

Elbert Weather's realistic gas model of the Aeronca lightplane which is a highly desirable type for gasoline propulsion.

THE aspiring Gas Model Builder usually comes to the question of what kind of a motor will suit his needs best. Of course, many model builders are influenced by seeing one type of motor running or the reverse, not seeing the motor in action.

This, however, should not bear too much on the final choice, as most motors now on the market will run according to the manufacturer's claim, providing that the instructions of the manufacturer are strictly followed.

The first consideration in the purchase of a motor should be the use to which it will be put. Generally, this is determined by the size of the model which the motor will fly—that is to say, the wing loading of the model.

For the small model of from 3 to 7 foot, weighing from 2 to 4 pounds, the Baby Cyclone motor will prove satisfactory. This motor comes ready to run for $15.75. For models from 6 to 12 foot and weighing from 5 to 7 pounds there are numerous motors available. The Hurlemen Aristocrat, Brown Junior and Tlush Super Ace, costing $21.50, are the most popular.

The new Gwin Motor, selling for $17.50 for the ready to run motor and $9.85 for the machined parts, which, by the way, unlike some of the motor kits now on the market, can be put together in about an hour to make a motor that will run as well as the finished factory motor is also gaining in popularity.

For the larger models from 12 foot up and from 6 to 12 pounds the Forster Brothers' Motor, selling for $17.50, is the best choice. Please remember that these sizes are only suggestions. Many models of 10 to 15 foot wing spread have been flown with Baby Cyclone Motors and small models of 200 to 300 sq. inches have been powered with the Brown Junior Motor.

However, this is going to extremes and, although such experiments are to be encouraged, successful flights are a matter of luck, which is usually absent in the beginner's case. It is better for the gas model beginner to stick to the more conventional sizes which assure him of more successful flights.

For the average contest model a motor should be bought which will fly the model well but still have a slight bit of power in reserve. The type of model will also have some effect on the motor. Models of a streamline design such as the Cavalier will fly well on less power than a model of the same size and weight but of a less streamline design.

The Baby Cyclone Motor features a rotary valve instead of the venturi tube used on most model gas motors. The rotary valve consists of a hollow crankshaft with a mixing valve on the under side of the bearing end of the case. The case is a die casting, cylinder of cast iron, as is the piston, and the cooling fins and head are of aluminum. The Cyclone comes ready to run, mounted with a tank, coil and condenser along with a can of oil and instructions for its running for $15.75 postpaid.

The Brown Junior Motor now on the market is an improved model of the original Brown Junior which will be remembered as the first model to be used in a model for contest purposes.

The Brown Junior is of 7/8 inch bore by 1 inch stroke and is one of the cleanest motors on the market. The cylinder, piston, rod and shaft are of steel, while the case is a die casting which, although extremely clean, is not the strongest way of making the part which absorbs the brunt of the inevitable crashes.

The Brown Junior comes ready to run, mounted on hardwood skids with coil, condenser, and is wired for bench testing. The motor is shipped in a wooden box with a can of recommended oil and a very detailed instruction book postpaid for $21.50. The Brown Junior has earned the reputation of being a dependable model motor.

The Hurlemen Aristocrat is an improved model of the first motor used by Maxwell B. Bassett in his early record breaking flights. The features of this motor are similar to the Brown Junior, excepting for a sand cast crankcase which is much stronger than the die casting type used by many other model motor manufacturers. This motor seems to have a little more power than the Brown, but does not run as long on the same amount of gas. Like the Brown, it comes postpaid with all accessories for $21.50.

The Tlush Super Ace, made by the well known Tlush Brothers of Lyndhurst, New Jersey, is a custom built job. Each motor is made under the watchful eye of Charles Tlush, who built several dozen different styles of motors before finally settling on his present design. The Tlush, like the Hurlemen, makes use of a strong sand cast

(*Concluded on page* 70)

Members of the Kresge Aero Club assembling their gas models in preparation for flights at the 1936 Nationals.

Building a Consolidated PB-2A

by

PAUL W. LINDBERG

Model Editor and Designer

for POPULAR AVIATION

Compare this fine little model with the drawing on the front cover to appreciate how closely the model resembles the full size ship.

OUR consolidated pursuit model for this month maintains high speed and exceptional maneuverability. If you follow the plans closely and carefully, you will be well paid for your efforts with a beautiful streamline model.

COLOR SCHEME

Fuselage—Army blue.
Wings and tail surfaces—Army yellow.
Details—silver, black and white.

CONSTRUCTION OF FUSELAGE

Place a sheet of ordinary wax paper over your plan for protection against cement. Now you are ready to go to work on your model. We suggest that you begin with the fuselage which is constructed one side at a time. The longerons, vertical and diagonal braces etc., are held in place until securely cemented. This is done by inserting straight pins on either side of strips.

When fuselage sides are completed, they are pinned to top view of the plan in such a manner that the top longerons face down and the sides are at right angles with the table. The cross-members are now cemented in place forming a rectangular fuselage.

Cut formers from sheet balsa and cement in their respective positions. Refer to plan. The positions of stringers are clearly shown on formers. Note: all stringers pass over tops of each former. If you follow this method, you will obtain a neater covering job.

CONSTRUCTION OF WING

This wing is made up of three separate panels. Cut all ribs from 1/16-inch balsa. Pin the spar in position on the plan. Now, cement ribs in their proper locations. The leading and trailing edges are cut and sanded to shape then cemented to the ribs. The panels carry movable ailerons which are a great help in controlling the flights. Make wing tips from 1/16-inch thick balsa. We highly approve of this type of wing tip, because it is much easier to construct and neater in appearance.

CONSTRUCTION OF ELEVATOR AND RUDDER

These are made from 1/16-inch square and flat balsa and are constructed on the plan. Their construction is easy, therefore you should have no difficulty here.

CONSTRUCTION OF LANDING GEARS

The construction of landing gears is clearly shown on the plan.

COVERING THE MODEL

Apply tissue to the various framework members. Use a light grade of model airplane dope to fasten tissue to the outer edges. Stretch tissue tightly as possible to remove all wrinkles. When edges have dried, apply coat of water to tissue. After water has dried completely, tissue will become taut. To prevent warping, pin wings, elevator and such to flat surface.

ASSEMBLY

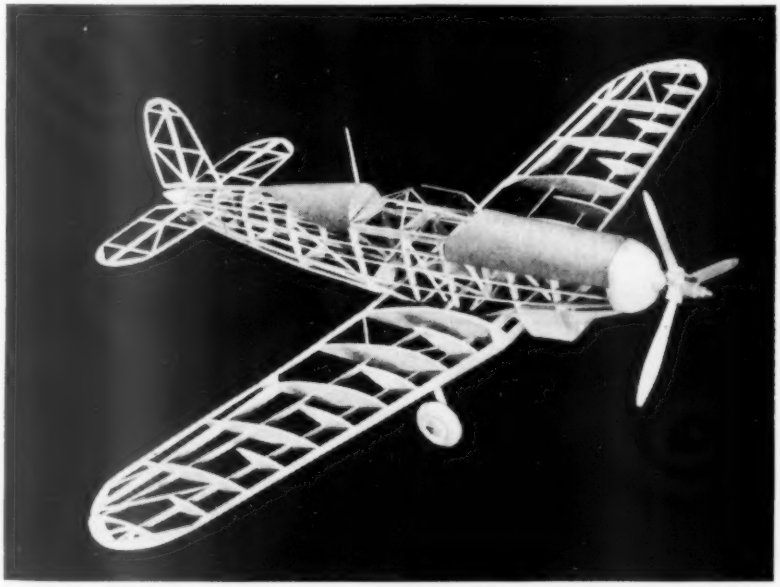
After the wing panels have been cemented to fuselage, make fillets from paper and fill in open spaces between fuselage and wing panels at trailing edges. Other small details are clearly shown on the plan.

TESTING AND FLYING

Two types of propellers are used on this model. One is made of fiber which has a much wider blade causing the rubber motor to turn at less r.p.m. and enabling the model to fly a greater distance. By twisting the blades, the pitch can easily be adjusted. The balsa scale propeller is used for exhibition purposes only. Six strands of 1/8-inch flat rubber are sufficient to fly the model.

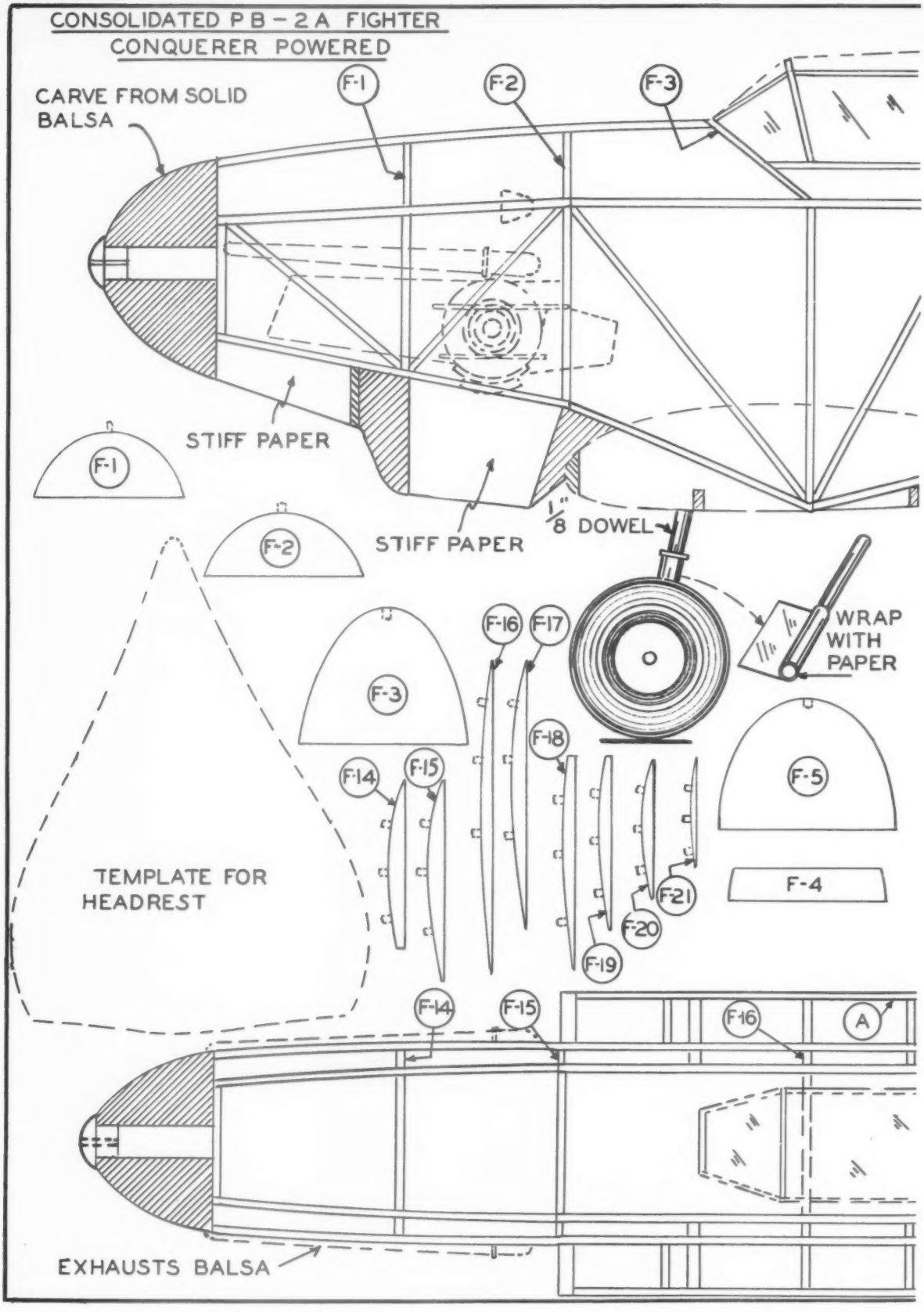
With the rubber motor and flying propeller in place, gently launch your model

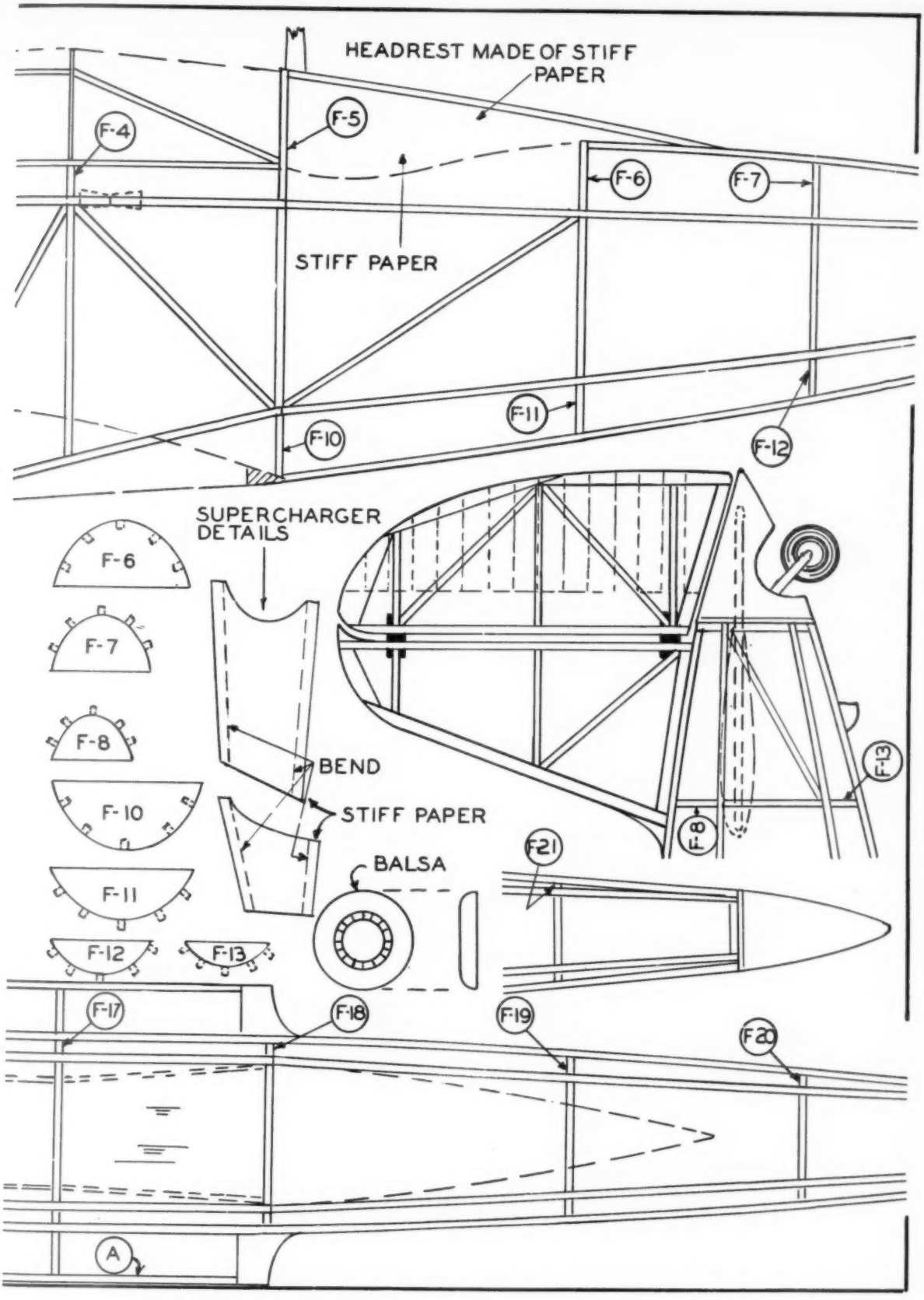
(*Concluded on page 68*)

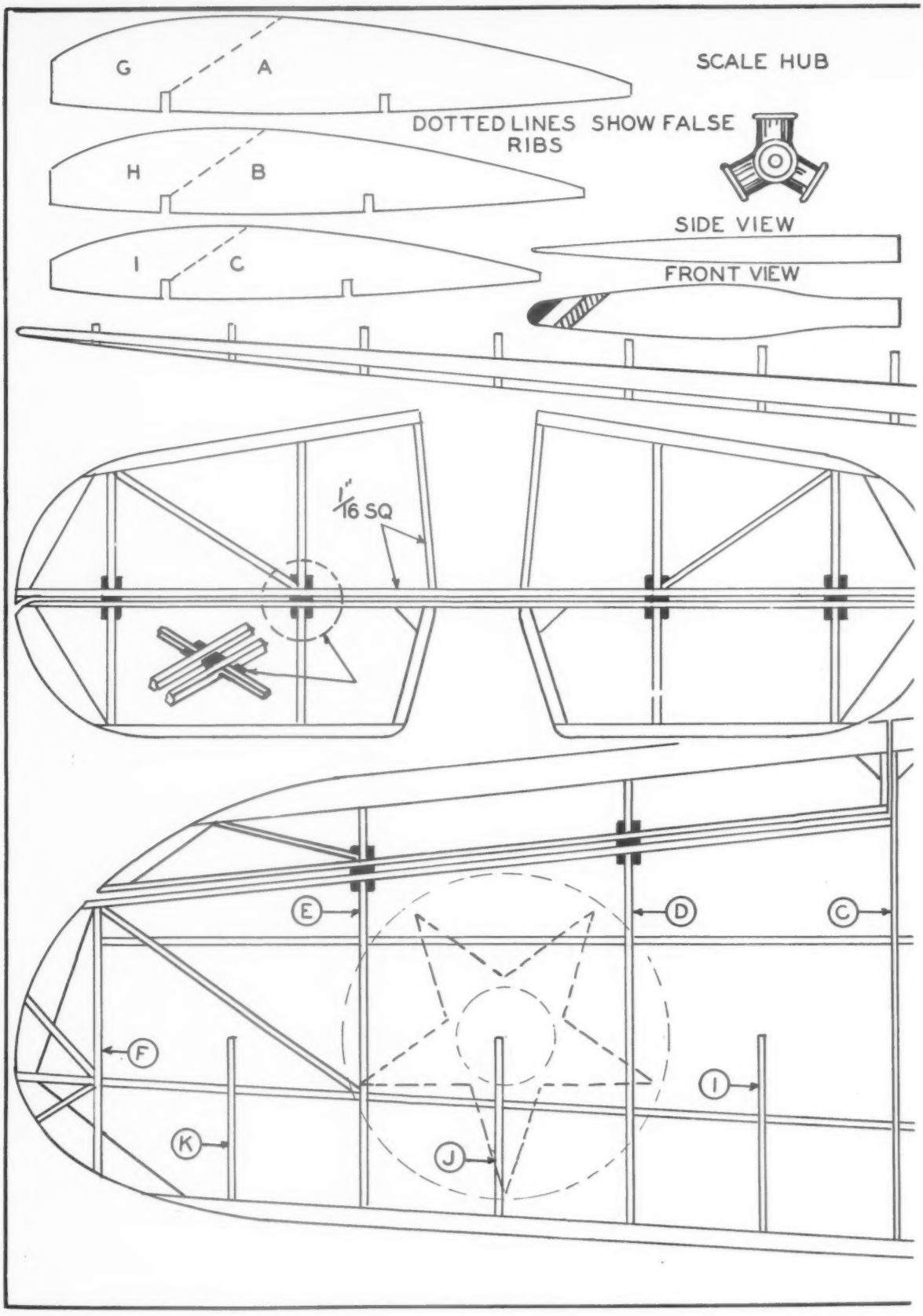


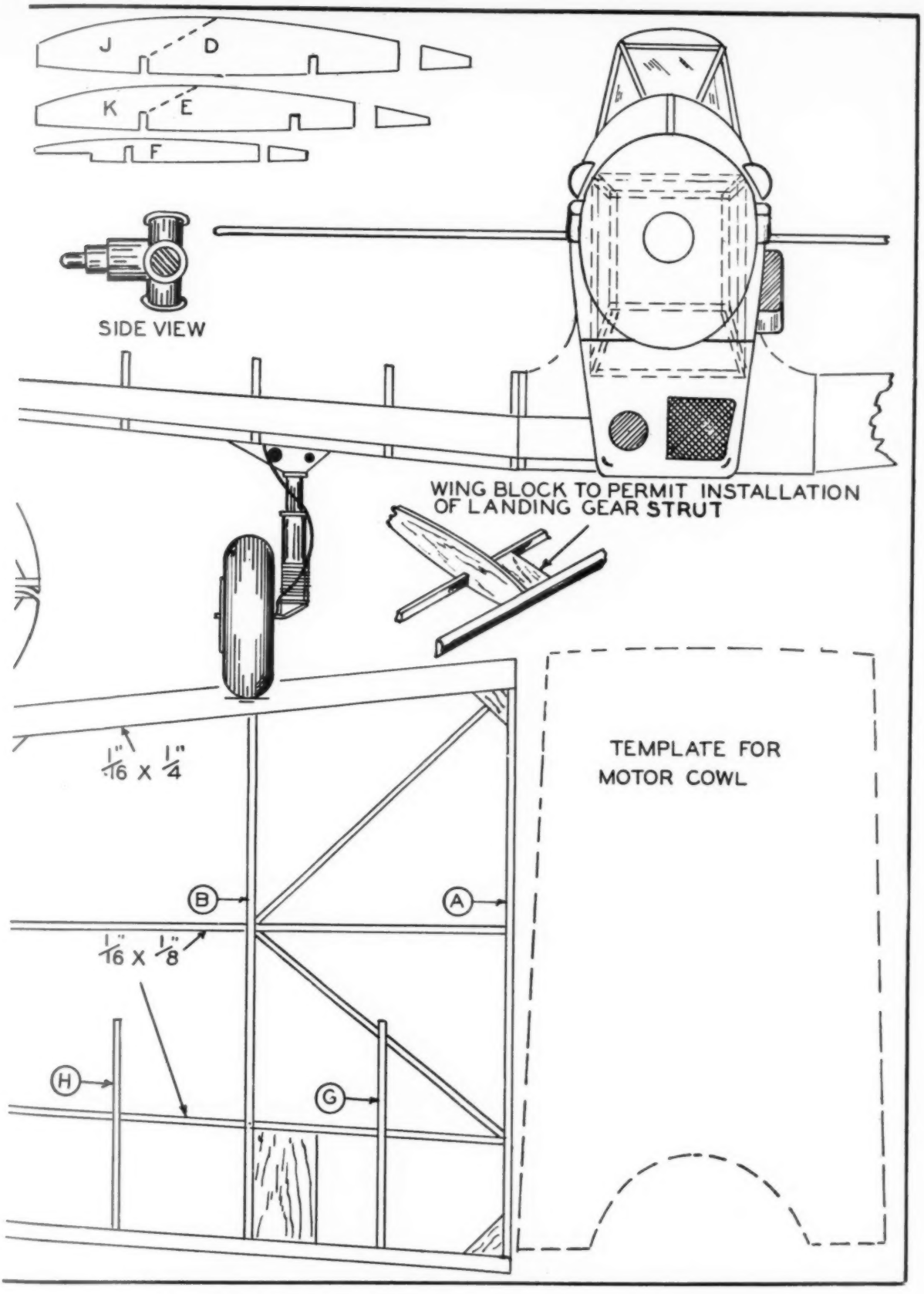
Here are the bones of the Consolidated PB-2A before the covering was applied.

XUM


CONSOLIDATED P B – 2 A FIGHTER
CONQUERER POWERED
CARVE FROM SOLID BALSA
F-1
F-2
F-3
STIFF PAPER
STIFF PAPER
1/8 DOWEL
WRAP WITH PAPER
F-16
F-17
F-18
F-14
F-15
F-5
F-4
F-21
F-20
F-19
TEMPLATE FOR HEADREST
F-14
F-15
F-16
A
EXHAUSTS BALSA


HEADREST MADE OF STIFF PAPER
F-4
F-5
F-6
F-7
STIFF PAPER
F-10
F-11
F-12
SUPERCHARGER DETAILS
F-6
F-7
F-8
F-10
F-11
F-12
F-13
BEND
STIFF PAPER
BALSA
F-8
F-13
F21
F-17
F-18
F-19
F20
A


G
A
H
B
I
C
SCALE HUB
DOTTED LINES SHOW FALSE RIBS
SIDE VIEW
FRONT VIEW
1/16 SQ
E
D
C
F
K
J
I


J
D
K
E
F
SIDE VIEW
WING BLOCK TO PERMIT INSTALLATION OF LANDING GEAR STRUT
1" 16 X 1" 4
TEMPLATE FOR MOTOR COWL
B
A
1" 16 X 1" 8
H
G

T-2003

(Continued from page 32)

Gradually, very gradually, the clouds lowered until they were almost on the ground. Hills made hedge-hopping too dangerous. Considering my own safety, the immediate safety of my passenger, the ultimate fate of the latter if I turned back and the bare probability that the weather would improve a bit nearer San Antone, I decided to go "over the top." For the required length of time I flew by compass. Finally I figured it was time to stall down through the goo and see how much ceiling there was,—if any. So down I went.

This time I had figured something else out. If there was no ceiling when I came out I'd come out on the ground, or against it. Would it be better to hit the ground at 105 m.p.h. or 55 m.p.h.? You answer it.

If the ceiling were zero and I got a brief glimpse of the ground with no place to land and I consequently shot up through the murk, back over the top and retraced my steps back a hundred miles my passenger would be dead before he finally got to the hospital. So you see it was vitally necessary to land through the fog.

With my load of gas and the pay load my ship had a landing speed of 52 m.p.h. She was moderately stable and wouldn't fall off in a spin if I kept a fair amount of forward speed. So I pulled up the nose and eased back the throttle until the air speedometer read 58 m.p.h. My engine, I could see was revving up about 1000 r.p.m. at this point, while my altimeter was indicating about a 350 foot a minute descent, as closely as I could time it. And so I kept her, flying by instruments alone.

And there was the ground, all around me. With a zero ceiling the horizontal visibility was nevertheless about 100 yards,—perhaps less. I came out over deeply, and freshly, plowed fields. Which was better than over San Antone or over the mesquite.

So I let her ride, with only a slight dip of the nose, until she hit.

Sure, the landing gear struts folded up, one wing tip was torn and the prop was a total loss, all of which I collected for. But neither of us was scratched and I got the kid to the hospital,—and he lived. And I lived too, merely because I had done two things,—

1. Decided there was a lot to this aviation business that I *didn't* know, and

2. Took the pains, spent the time and sometimes humbled my pride, and *learned everything* I could about it.

Captain Frakes

(Continued from page 16)

aviation, it looks as though I had about reached my zenith in the racket. However, there are still thousands of people who have never seen a ship crash and so my future is entirely concerned with them.

I have had the good fortune to meet Mike Barnes, a real showman and salesman who operates the top notchers. I congratulate myself on having become closely associated with him in my racket and rely absolutely on his ability. I'll crash a plane wherever Mike tells me to crash it for he only plays reliable dates. When a flyer is his own manager he does not collect his remuneration as regularly as he should from the various fairs and carnivals, and it takes a man with real show ability.

I have been asked by thousands of people how I do, for a living, the one thing that pilots most fear. Well, in the first place, the answer is to get fear entirely out of your system. Never, by any means, let fear creep into your mind nor let it be suggested to you by others. Keep the word DANGER on the billboard and out of your head. I'll even go farther and say that danger is the direct result of fear, rather than the other way about and, if a man is continually nursing fear in his mind he is always in grave danger.

By this I do not mean that a man should be reckless, quite the contrary, but I do mean that he should put his whole attention on the act to be performed and on nothing else. Do not be over-confident nor bull-head but just let common sense and good judgment rule your activities while in the air. Figure things out and reason them out before you start, and then whatever may happen, stick to your first ideas and scheme and keep a cool head. Split seconds count in flying, especially when in distress and this is no time to invent new methods.

A pilot, frozen, hasn't one chance in a hundred of coming out of a predicament alive. All the crates that I have crashed will come down nose first like a plummet whether gliding, slipping, spinning or skidding, and all of my energies were devoted at preventing that nose from hitting anything solid at the first impact. Just let the crate land nose first on something hard and he will be wrecked himself in short order. Crashing an airplane is safe and easy if you know how and if your antique ship doesn't develop the heebie-jeebies before you land.

There is a saying to the effect that any landing is a good landing if you are able to walk away without assistance, but this is stretching matters quite a bit even when crashing a plane. I never let a forced landing worry me a bit. If I'm coming down in rough country I just pile the old crate up in a heap, crawl out from the wreckage and forget it. This is one advantage of having crash landing experience.

Crashing a plane is quite a job and I am well aware of the fact that the next one may be my last one because there is always the unexpected that can happen. I am not fearful, but my blood will chill in my veins just as will yours when I think that the end has come. More than once I have stared death in the face and have had a glimpse of the pearly gates, and I believe that I would have been killed long ago if I had not the ability to stave off fear.

It was in 1919 during a forced landing that my ship got into a spin and I had my first experience of semi-death in mid-air. I was flying at 4,400 feet when my engine failed me and I failed to push the stick forward before she stalled, and then the old Jenny wound up in a nice tight spin. I went blank and the plane came out of the spin by herself just as I came back to life. I came to, just in time, to land it right-side-up with only slight damage to the ship. It was here that I learned my lesson on the subjects of fear and self-control and the lesson still sticks with me.

I, like many other travelling circus pilots, have had several close shaves en route, such as sitting down in the tops of trees, getting caught in hail storms and similar accidents, but by far the greater number of my crashes have been intentional, bought and paid for in advance by the fair and carnival people.

This season, just past, has been a very busy one for me. I have crashed a total of nine planes, completely demolishing them, and finally destroying them by fire as I step from the wreckage. Most of the crashes have been made at state fairs but some have also been made for the movies. I have crashed all kinds of planes in all kinds of ways, on the ground, in trees, in the water, against houses and against mountainsides, but I use no protection but a breast belt in addition to the regulation belt.

It is much easier to crash for the movies than before the public at a state fair for you can postpone a movie flight if the wind or weather are not right, but when the advertised time has arrived for a public flight you must click exactly on time regardless of the weather.

Weather is one thing that the pilot must study and understand for there is no reliable instrument that I know of that takes the place of weather-wise judgment. There is no instrument that I would trust my neck with in bringing a ship down blind into a crash. The airlines talk much about blind instrument flying and its wonders but I also note that their average schedule is only about 78-percent. when it should be 100-percent.

END

FORDON-BROWN
National Air Show, INC.
720 BOOK BUILDING — DETROIT, MICH.
PRESENTING
America's Greatest National Air Show!
★ ON NATIONWIDE TOUR WITH Milo Burcham—C. W. "Flash" Whittenbeck—Capt. Dick Granere—Joe Jacobson—Harold Johnson—Charles Abel—Buddy Batzel—Hugh Thomasson ★
TAMPA, FLA., JAN. 10 WEST PALM BEACH, JAN. 23-24, 1937

The Birdmen's Perch

Our New Year's resolutions for The Perch are: (1) bigger whoppers, (2) funnier gossip, (3) crazier squibs. This is a first-class platform, especially since it's up to you fellows to deliver the news. Why don't you sit down right now and send us a few tales out of school? Address the scandal to:

MAJOR AL WILLIAMS, *Manager, Aviation Department,* Gulf Aviation Products, Gulf Building, Pittsburgh, Pa.

A LETTER FROM AUSTRALIA

"I would like very much to correspond with American aviation enthusiasts. If you could mention this fact in your page, I should be very pleased.

"I would like correspondence with either sex, so long as the persons are not more than twenty years of age.

"My name is Douglas Chambers. The address, Burbanks, Via Coolgardie, West Australia.

"I sincerely hope this will not be too much trouble to you. I think you ought to start up a pen friends club. Don't you think so, too?"

WE POINT WITH GULFPRIDE

We learn that Eastern Air Lines has recently completed its 32-millionth passenger mile using *Gulfpride Oil.* Two bouquets for this swell record: one to Eastern, the other to Gulfpride!

CHARLIE'S BEEN FOUND

Sometime ago in your column you wondered as to the whereabouts of Charles Augustus Macatee 3rd, who used to fly in these parts.

Well, this bird has finally settled down as a co-pilot with American Airlines. He is assigned to the New York-Chicago via Washington run, and twice a week comes through and leers at us from the pilot's compartment of a Douglas.

Mr. Macatee has also managed to wangle himself a commission as an Ensign in the Naval Reserve, and last summer spent two weeks at Cape May on active duty, scaring the natives and summer visitors to death.

—JAY SCOTT, Washington, D. C.

PENNSYLVANIA-CENTRAL LANDS 230 POUNDER

R. L. (Bud) Baker has been named Chief Pilot for the recently formed Pennsylvania Central Airlines Corporation.

He has 50 pilots under him, and they love it. Personally, it distresses us to think of *any* pilot being under him, for Bud weighs around 230 pounds.

Incidentally, both Pennsylvania and Central Airlines have long been enthusiastic users of Gulf Aviation Gas—and the new combine plans to continue this sensible procedure.

MATERNITY MAN

An Eskimo woman in an isolated Alaskan village was about to have a baby. The Indian Service nurse wired for a plane to rush the native woman to the Fairbank's hospital. Soon the ship was whirring low over the settlement.

The nurse pointed out the window and said to her patient, "Look, there's the airplane that is going to take you to the hospital."

Maybe she thought it was the stork, but anyway the expectant mother, frightened half to death, had her baby then and there. Special Delivery, so to speak.

—K. B.

THIS MONTH'S WHOPPER

A pilot who combines flying and fishing tells this story:

"Last summer I flew up to a mountain lake, sat down, got on one of the pontoons and began casting. No luck. Meanwhile an old gent in an equally old boat was catching plenty of good fish.

"Inquiring what bait he was using, he replied, 'Frawgs.'

"So I beached my ship and went looking for frawgs. Chased several small ones with no success. Heard a thrashing in the underbrush, and on investigation discovered a medium-sized moccasin trying to swallow an oversized frog.

"Rushed back to the ship to get a weapon to kill the snake. I grabbed my oil can (filled with Gulf Aviation Gas for priming) deciding to 'gas' the reptile. Ran back and knocked the snake silly with a small stick, the frog slipping from its mouth.

"Put a foot on the frog to save him for bait, at the same time giving Mr. Moccasin several squirts of Gulf Aviation Gas down his throat.

"Took my frog and returned to my pastime. No luck, but did a beautiful job of drowsing in the warm sun. Was awakened by a gentle tapping on my thigh, and looking down, there was Mr. Moccasin with a very pleased expression on his face and another frog in his mouth."

—"Deepwater Jim" Melton

Gulf Oil Corporation and Gulf Refining Company . . . makers of

GULF **GULF AVIATION PRODUCTS**

Heath Planes

(*Continued from page* 18)

was no damage, but it impressed on me how foolhardy it is to risk several hundred dollars' worth of lightplane on a set of cheap spark plugs.

From my experiences with builders and flyers of Heath lightplanes I have found them to be a fine bunch of fellows who really enjoy flying these little planes and have built some fine looking planes that would do credit to some American factory-built jobs. I know of several fellows who actually taught themselves to fly in Heath Parasols, but they admit that self-instruction is not as inexpensive as it might seem, due to the cost of replacing broken props and landing-gears.

If you don't believe that the little crates can take it, ask W. B. Stevens of San Antonio, who flew old 10374, a Model V Parasol, from Chicago to Port Arthur, Texas, in less than thirty hours' flying time. Gene Gallagher of Niles, Mich., who has probably flown Heath planes more than any other one person is flying larger ships a lot these days, but still enjoys hopping the little parasols around.

Howard Anthony, manager of the Heath factory, built and flew his own Parasol before becoming connected with the factory and now flies his own Centerwing all over the country on business trips.

END

COME---

And Bring A Friend!

From Maine to Mexico the fraternity of air minded people are heading for the National Aviation Show. They're coming to rub elbows with hundreds of aviation's most prominent personalities at the greatest exhibit of aeronautical progress the country has ever known. The famous Grand Central Palace will sparkle with displays from every branch of the industry—Aircraft, Engines, Accessories, new Technical Devices, Government Exhibits, Schools, Model Aircraft, and a host of startling new developments.

Come! Join the crowd! See the sights! Meet the pioneers of this great industry!

NATIONAL AVIATION SHOW

NATIONAL AVIATION SHOW

GRAND CENTRAL PALACE, NEW YORK CITY

JAN. 28th to FEB. 6th, 1937

Sponsored by:
Aeronautical Chamber of Commerce of America, Inc.,
Aviators' Post 743, The American Legion

Material Division

(*Continued from page* 22)

starters; improved flying clothing; transportation equipment; radio engineering; instrument development (whereby blind flying became a splendid reality); noise reduction, sighting and listening devices; and dozens of flying instruments.

In the Material Branch raw materials are subjected to exhaustive tests. These include fabrics, metals, rubber, paints and varnishes, etc. Development of non-shatterable glass, spot welding, solders, synthetic rubber, balloon and parachute silks and countless other materials are all part and parcel of this vastly interesting and important Branch.

Last, but scarcely least from the military point of view, is the Armament Branch. Machine guns, bombs, ammunition, gun sights, fixed and flexible guns, synchronizers, timing devices, correctional instruments, pyrotechnics, including signal and lighting flares, are handled by this branch. Visitors at the field are invariably amazed at the size of and weight of aerial bombs displayed in the Wright Museum. He thus has no difficulty in appreciating the need for devices and instruments enabling airplanes to carry these death-dealers.

These are the main divisions of the Materiel Division.

From the foregoing description, sketchy at best, the reader can gain a ready insight into the need for men who are capable of handling the multitudinous projects the Army must constantly be carrying on in order to have a highly efficient air force.

But more than that: he can see where he, himself, might fit into the picture: the mechanic, the materials expert, the inventor with his devices for improving flight and flying conditions, etc. It is patent that outside of the industrial plants, some of the greatest opportunities in the world for successful association with aeronautics are located at Wright Field, center of Uncle Sam's aviation experiments.

There is, of course, also, the large personnel of civilian employes who come under civil service, with occasional openings. Application may be made through the usual channels, with information concerning requirements and qualifications, as well as types of positions open, available at post-offices or through inquiry by letter. A few lines to the Personnel Bureau will elicit the desired information.

Wright Field has one of the world's foremost aeronautical museums. It contains airplanes, engines, instruments, models, photographs and all kinds of materials. The hangars at the field are always filled with military aircraft, most of which are shown to visitors. Practically every type of military airplane is represented.

The Air Corps Engineering School is another adjunct of the Field. It is conducted to instruct officers in the fundamental principles and practices of aeronautical engineering and there are usually about a score of students in attendance. Air Corps officers only are eligible.

Wright Field also has a superb library where 10,000 volumes, 120 current magazines, American, British, French, German

XUM

and Italian, and an invaluable collection of foreign and domestic technical reports are on file. The majority of these are available for loan and advantage of this privilege is extended to industrial concerns, technical organizations, universities and individuals. Technical reports have a circulation of about 600 a month.

Considerable test flying is done at Wright Field. Most of the work is on experimental jobs in which performance of airplanes and equipment is studied, checked and changed. Thousands of such flights are made annually without mishap or serious accident. There is very little loss of life among the select few who comprise the hardy group engaged in this hazardous work.

Aviation history has been made at the Materiel Division. Here are some highlights of the years since it was founded: Major Schroeder established a world altitude record, 33,113 feet (1920); Lieut. Macready broke it by more than 1,000 feet (1921); Capt. (Stratosphere) Stevens set world parachute jump record, 24,200 feet, night flying was begun, and Lieut. Harris became first in the nation to save his life by a 'chute, all in 1922; Barling bomber flown, world speed record broken, using a DH-4L (1923); first radio interview between a pilot and reporter on ground (1924); first radio beacon installed (1925).

Materiel Division moved from McCook (Dayton) to Wright Field (a few miles outside), (1927); Capt. St. Clair Streett, Lieuts. Macready and Nelson awarded D.F.C. for world-famous flights (1928); Capt. Stevens photographed Mt. Rainier from 227 miles away (1929); first jump made with manually-operated parachute (1930); enlisted man developed device to separate water from gasoline (1931); first solo instrument landing flight accomplished by Capt. Albert F. Hegenberger (1932); world's first class in instrument flying graduated (1933); plans for stratosphere flight by Maj. W. E. Kepner and Capt. Stevens developed (1934); instruments developed for world record stratosphere flight (1935); Capts. Frank Irvin and Jack Griffith land flaming bomber while five civilians become members of the Caterpillar Club (1936).

Wright Field has a personnel of about 1,200. It occupies 746.78 acres, of which 520 comprise the flying field, along the Springfield Pike, five miles outside Dayton. The entire government reservation there, which includes Wright and Patterson fields, measures 4,549.54 acres. The latter field is devoted to maneuvers, stores, and a model air corps officers' village, unique in the annals of the service.

The ground for Wright Field, costing $450,000, was a gift of the citizens of Dayton to the federal government. The field is generally triangular in shape. It has a landing area of a mile each way. More than 40 buildings house the Materiel Division activities, with floor space totaling nearly 1,000,000 square feet.

Brigadier General A. W. Robins is commanding officer.

END

Swanee Taylor

(Continued from page 36)

didn't sprint forward for the customary gab fest until the pilot throttled back to land. But when he did start his glide, up she went, hippity-hop, to throw open the door and coo her questions. (Mind you now, she is a registered nurse, and reputed to be the hardest-boiled one on the line!) However, the instant the pilot turned his gory face upon her all inquiry faded from her eyes and without a word she rocked back on her heels and fainted dead dead away.

Hip-hip, hip-hip, hooray!

Believable Truth

Here, my friends—and those who chided me so—is a very believable truth about the Bureau of Air Commerce's Hammond plane. And it is the gospel truth: The little fellow has been dismantled and is stored away down in Washington against posterity's curious gaze, along with electric powered automobiles, bustles and hoop skirts.

END

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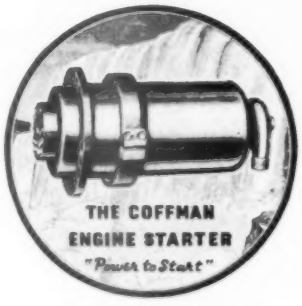

WRITE FOR BOOKLET NO. 49

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The National Air Board

(*Continued from page 38*)

which speeds of 1,500 miles per hour are developed and in which the flow past airfoils at speeds above sound are vividly pictured. It is astounding to see how different the airflow is when sound compression or shock waves are formed.

A totally different type of airfoil and body will have to be designed when we seek for speeds substantially higher than those of the fastest racers of to-day. For the first time in these moving pictures there was shown to the world at large the seaplane tank at Guidonia, the aircraft research city which has grown up in Italy. In this tank a complete seaplane model, 15 feet in span, can be towed at speeds approximating sixty miles an hour. This tank is really large enough to approximate actual conditions and our Langley Field tank is almost dwarfed by this new laboratory.

DO GLIDERS NEED AN A. T. C.

Mr. Southee brought up the following question. "Why must glider builders comply with the same A. T. C. requirements as a Douglas transport?"

As is well known the stress analysis and other requirements for the obtaining of an A. T. C. have steadily grown since these requirements were first enforced. For transport ships involving as they do the safety and lives of thousands of air travellers such regulations are no doubt perfectly justified and airplane plants which invest hundreds of thousands of dollars in a new type of aircraft probably feel it no hardship to go through complex engineering calculations.

But even though a man may conceivably be killed in a glider, is it necessary to burden the amateur glider constructor with the same complex regulations? After all gliding is a sport and a bobsled employed in an equally hazardous sport does not have to meet any regulations.

The consensus of opinion of the Board was *that while some Federal supervision of glider construction was necessary, regulations in this field should be as simple and unhampered as possible.*

SHOULD THE GOVERNMENT ISSUE GLIDER PLANS TO AMATEUR BUILDERS?

Mr. Southee also suggested that the Government should foster gliding by issuing complete plans to amateur groups on request.

The arguments in favor of this step were that the Army issues a Handbook of Instruction to designers, that the Department of Commerce releases information to designers and that it was much more difficult for amateur glider builders to secure amateur drawings than for the aircraft manufacturers to prepare their own drawings.

The Air Board came to the definite conclusion that it was not the function of the Government to issue glider plans, since private concerns were already engaged in such activity. If the Government issued glider plans, why not issue airplane plans?

Incidentally the point was brought up that gliders not being engaged in interstate flying perhaps do not come at all under the jurisdiction of the Federal Government.

THE FIRST NEW YORK SHOW IN SEVEN YEARS

In New York at the Grand Central Palace there will be held from January 28th to February 6th an Aircraft Show sponsored by the Aviators Post of the American Legion, with the full support of the Aeronautical Chamber of Commerce and the aircraft industry at large.

Some members of the Board felt that an aircraft show was an undue burden on the airplane manufacturers and sales representatives. Captain Depew spoke with much feeling of the deadly boredom and tiredness which overwhelms the exhibitor at his stand answering questions all day and handing out vast quantities of expensive literature without a single prospect appearing. At least, said Captain Depew, shows should be held near a flying field so that planes could be flown to the show without the nuisance of dis-assembly, trucking in, assembly, and so forth.

A contrary view was voiced by Captain Brooks. Surely a show gave other benefits than those of direct sales. Perfectly true that large numbers of small boys make themselves an intolerable nuisance, but is it not important to educate these small boys and the public in general? Shows have an indirect influence on public feeling which was well worth the trouble and expense.

In view particularly of the fact that the last New York aviation show had been held so far back as 1930, *Augustus Post thought that this particular show, well conceived and in all probability well executed, should be an outstanding aviation event of the year 1937.*

ARE SINGLE SEATERS OBSOLETE?

An aeronautical engineer of great experience who prefers unfortunately to remain anonymous brought to the Board some very excellent arguments to indicate that single seater fighters were now obsolete. Bombers now have speeds close to three hundred miles an hour. Single seaters of even greater speeds may readily be built, but they then lose their power of intense maneuver. To ask a man to flatten out instantly after a dive of four hundred miles an hour is courting disaster.

A single seater can dive and fire in the same direction and is therefore forced to get on to the "tail" of the bomber for one crack at its target and get away. A bomber on the other hand is capable of fighting back all over the sky and is now more than a match for the lone fighter. Would it not be better said this engineer, of undoubted authority in this field, to discard the single seater and build instead multi-place fighters which could have a wider range of fire; which with one man disabled could still descend in safety; and which would be big enough to carry many guns?

To all these arguments Captain Brooks had valid rejoinders. "Single seaters," said Captain Brooks, "can stay out of range, they can carry cannon with a longer range than the machine guns of the bomber. The broad side fire of the multi-place fighter is erratic. A bullet emerging from the side of the ship is deflected by the wind and is apt to be erratic. A swarm of single seaters even if some of them were sacrificed would still be the most powerful defense against a bomber. As an intercepter the single seater still remains supreme. Bombers were even to-day not at all armored and had many vital spots. A single shot in the control surfaces would put the largest giant of the air out of commission immediately."

The consensus of opinion was that while multi-place fighters should undoubtedly be included in any rounded plan of air defense, the single seaters were there to stay.

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TWO-CONTROL OR AUTOMATIC PILOT

The question here was: "Recently two-control airplanes have been developed. Would it not be preferable to simplify flying for private planes with a cheap form of automatic pilot?"

Captain Depew here brought the light of practical common sense to bear. An airplane moves in three dimensions and always will have control about three axes. Captain Depew really had no patience with notion that it was so insuperably difficult to work hands and feet in the airplane.

He compared the situation with what a driver has to do in the automobile: clutch, brake, throttle control gear shift, etc., etc. Really when the common and generally accepted requirements of car driving are taken into account, piloting an airplane can in no wise be said to impose a greater task on a man's capacity. Nor does it appear at all certain that any two-control airplane will ever give the precision and certainty of maneuver that a well designed three-control airplane now affords.

Discarding the possibilities of two-control the Board thought that it would be now highly desirable were a cheap form of automatic pilot available to the public. Automatic pilots are now being placed on every transport airplane. They give greater smoothness of flight to passengers and relieve the pilot of intolerable fatigue of long journeys.

At present unfortunately the automatic pilot may cost more money than the entire small airplane. After the manufacturers of automatic pilots have completely conquered the transport field they will undoubtedly turn their attention to a cheaper form of automatic pilot for private flying, so that instead of being an impossible luxury the automatic pilot will become another commonplace accessory making for greater safety and greater ease of operation.

END

International

(Continued from page 40)

to be the French equivalent of the nine rahs.

Joseph Mackey, who specializes in sky-writing, had helped advertise the show on the two preceding days by sprawling "OK Paris" above the boulevards. Since sky-writing seems to be an American art, the red and white Waco was the center of much attention, and the only way the genial lieutenant could escape the besieging hordes of autograph hounds, was to get into the air. His particular brand of snap-rolls, Immelmann turns and outside loops drew enthusiastic applause. "That is what I call *smooth work,*" we heard an Englishman remark.

Marcel Doret, whose sensational stunting was one of the high-lights at the National Races in Chicago in 1930, whipped his speedy little Dewoitine-Hispano off the ground and went through the bag of tricks. One could not mistake the rakish tilt of his wings, as he careened overhead. Again and again he dove in over the tree tops and fanned the grass in front of the grand stands. The movie-tone men dodged, as he zoomed over their heads, and whirled their cameras in a vain attempt to hold the silver ship.

In their turn, the other flyers took the limelight. Louis Massotte, trailing yellow smoke from the wing tips of his Spad, painted arabesques against the sky. Michel Détroyat, darling of the French air fans, drew rounds of applause, though he did not attempt to out-shine the Americans. It may have been French chivalry but it was probably because his new Morane biplane was too stiff to put on a finished performance.

END

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POPULAR AVIATION 25c

Beachey

(*Continued from page 20*)

the tutelage of Hugh Robinson, one of the first airplane pilots in the world. Robinson was flying for Glenn Curtiss at the time. From that day on Beachey was an airplane pilot in heart and soul. By the summer of 1911 his name was known around the world as the greatest stunt flyer of the age.

What thrills Beachey could not concoct for himself and his audiences in the daytime he would work on at night. He soon became famed as the first night-flying stunt pilot in the history of aviation. Stunting with magnesium flares wired to the wings of his flimsy Curtiss pusher was one of the highlights of Beachey's shows at the Panama Pacific Exposition.

The time-exposure photograph shown with this article is a rare relic of the days when Beachey reigned supreme. This picture, loaned to POPULAR AVIATION by G. Warren Metcalfe of Baltimore, Maryland, who saw Beachey fly at Baltimore, was taken a few days before the famed aviator was killed. When this photograph was made, Beachey was giving a stunting performance at the Panama Pacific Exposition with a burning flare attached to his plane. The photographer opened his camera's shutter and the flare on the stunting plane traced its path on the exposed plate.

So today Arthur Mix works in an airplane plant where any one of the airplanes turned out by that company is ten times safer and more reliable than one of Beachey's old pushers. But, for all that, there is no pilot in the world today, so far as Arthur Mix is concerned, quite like aviation's first great stunt pilot, Lincoln Beachey. END

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Seaplane

(*Continued from page 40*)

In landing, the approach is made in the same manner as with a landplane, but the final leveling-off may either take place when the pontoons are three feet above the water, or nearly on the surface, depending on whether a slow landing or a "step" landing is made.

The slow or "squash" landing is more desirable, because the rear part of the pontoons will penetrate the water more, cushioning the shock, and the high angle of the wings will further aid in reducing the force of the contact. After leveling off for this kind of landing, the ship will settle rapidly, as flying speed is lost, the stick being pulled back all the way as it settles, causing the rear of the pontoons to strike first. It is during the loss of flying speed that the beginner experiences the greatest difficulty.

He either tries to put the ship on the water too soon by pushing forward on the stick, which causes a bad rebound, or else he pulls the stick back before the machine has lost sufficient flying speed.

In a "step" landing, the pontoons make contact with the water in a more or less horizontal position, at considerable speed. In this case, flying speed is lost *after* contact. The controls are held in neutral, or slightly back, until the ship stops planing.

If it is pulled back too soon, the machine will skip off the water and rock badly. This type of landing is a very pretty maneuver when skillfully done, but is hard on the pontoons if a blunder is made, such as letting them strike on the nose, causing them to either "dig in" or make the ship bounce up a dozen feet or more.

Finally, don't forget that the pontoons raise the plane up a foot or two higher than with a wheel gear. Take this into consideration in judging your height from the water if you're used to the ship as a landplane. END

Adventure

(*Continued from page 24*)

and in a few minutes commenced felling trees, that stood near the shore. As each tree fell, Stull guided its fall on the rock. In ten minutes he had a rather substantial bridge—but the men on the rock were too weak to cross it.

Gathering his rope about him, Stull made his way across the improvised bridge. Carefully he fastened each man to him and then assisted them to get on their feet. In this manner, guiding them gently, he succeeded in getting them ashore. A few minutes later they were seated before a roaring fire at their cabin while Stull prepared hot drinks for them.

Stull's report to his company on this incident is a masterpiece, "Called at Island River and picked up three men."

Those are a few of the highlights in the lives of men who fly the frozen lands. They are pilots from their heads to their toes but on top of that they are animated bundles of ingenuity, ever ready to tackle any problem facing them and entirely able to take care of themselves in any emergency.

The younger element today, who will be the famous pilots of tomorrow can do no better than follow the leads set by these veterans of the skies. If they are able, and we know they are, to fill the bill in the same offhanded manner, then we have nothing to fear. We will be proud to know the younger generation are capable of taking up the work where the veterans have laid it down.

It takes the continual presence of danger to develop this sort of piloting and of danger there is plenty—

On March 19, of that year, it was flown to the rescue of the party headed by Charles F. Gould which had been marooned in a blizzard at the base of Rockefeller Mountains when the high wind overturned their Fokker monoplane anchored to the ice. The Fairchild carried the party back to Little America in two trips.

END

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Airy Chat

(*Continued from page* 12)

are rich entitled for their share in the development of the aviation engine. If it were not for the fine engine lubricants now being marketed our present airline schedules would be impossible and transatlantic flights would be unknown.

The modern aviation engine is not so greatly different from the engines of twenty years ago and yet what a great difference in their performance. To a very great extent this improvement is chargeable to the tougher and more resistant lubricants and the high octane gasoline ratings devised by the refiners.

* * *

BACK in the days when castor oil was in its prime as an engine lubricant, the flights were short and the carbon in the cylinder heads was hard as flint. After the oil once cooled down, the piston rings and frequently the pistons were welded fast by the hard congealed castor oil gum. Them were the days!

And at that, castor oil in the rotary cylinder and radial engines was far superior to the petroleum products then on the market. The petroleum oils simply could not then stand the punishment of the high compressions and running temperatures and thereby limited the reliability and the duration of flight.

The progress in the production of petroleum lubricants has been nothing short of marvelous and has contributed largely to the reliability and efficiency of the engines.

* * *

WE have had many replies to our airplane museum, a great many being quite enthusiastic over the subject while others reminded us that there are already many airplane exhibits around the country, those of the Smithsonian Institution being an example.

However, it was our idea to have an exclusive aeronautical museum and not simply exhibit a few airplanes as a side-line to the main theme of another museum. It was not our idea to confine the exhibits, as has been done heretofore, to a few record breaking planes, but to include the humblest specimens that proved to be stepping stones on the way to progress.

And, in addition to the planes themselves would be the essential accessories to the airplane that made flight possible, such as the propellers, tires, wheels, fabrics and the thousand and one other items that enter into the total assembly. Exhibiting simply planes that have broken some sort of records, and are being exhibited simply to illustrate that record, does not interest us as much as the links in the development.

* * *

NOW that the boys have been holed in by the winter snows and icy blasts for some time, we are starting to hear of many new clubs of the fireside variety which is a mighty good sign that the fellows are still thinking about aviation even though the inclement weather prohibits any practical activities along that line. Write in and give us the dope on your latest assembly.

* * *

AUTOMOBILES are now receiving concerted volleys from the daily press. The papers point to the great number of automobile accidents taking place, giving their statistical data in the form of misleading totals instead of percentages. I am sympathetic in this case, in view of the similar wild defamations aimed at the airplane.

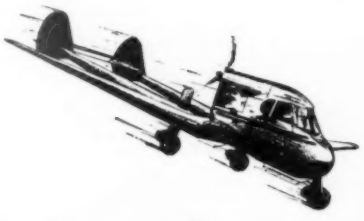
I will ask you to remember that, in the very great majority of these statistical distortions, all sorts of vehicles are listed under the head of automobiles, motor trucks, street cars, railroad trains, motorcycles, etc.

If a railroad train wrecks an auto, it is an automobile accident. If a fat-headed street car motorman jams into an automobile waiting for the lights to turn, it is an auto accident.

If a nit-wit befoozled gang of highway commissioners dig a nice big unprotected pit (without lights) in the middle of a highway, and a car falls into it, it is just another auto accident. On the other hand, if an automobile ran into and wrecked an airplane, then it would be featured in screaming headlines as "Airplane Crashes."

Don't take this sort of thing too much to heart. I haven't forgotten that a horse-drawn hearse ran over and killed a man in Philadelphia in 1897.

Well, so long. J. B. R.



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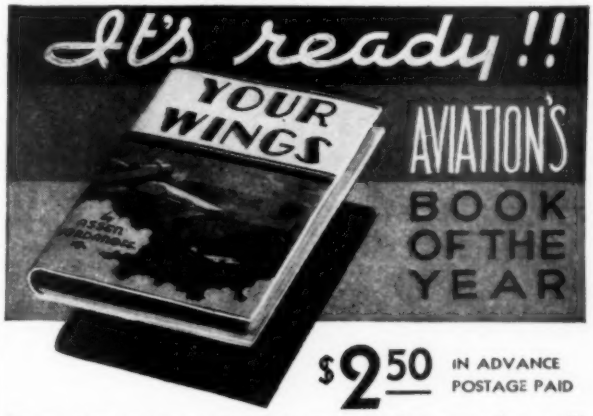

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Speed

(Continued from page 44)

given. These tables are ordinarily not available quickly. The P/S value on light planes is always with low power, a decimal. As the cube root of a decimal is a lengthy complex problem they are here given.

TABLE IV

Number	Cube Root	Number	Cube Root
.01.....	.215	.51.....	.799
.02.....	.271	.52.....	.804
.03.....	.310	.53.....	.809
.04.....	.342	.54.....	.814
.05.....	.368	.55.....	.819
.06.....	.391	.56.....	.824
.07.....	.412	.57.....	.829
.08.....	.430	.58.....	.834
.09.....	.448	.59.....	.838
.10.....	.464	.60.....	.843
.11.....	.479	.61.....	.848
.12.....	.493	.62.....	.852
.13.....	.506	.63.....	.857
.14.....	.519	.64.....	.861
.15.....	.531	.65.....	.866
.16.....	.542	.66.....	.870
.17.....	.554	.67.....	.874
.18.....	.564	.68.....	.879
.19.....	.574	.69.....	.883
.20.....	.584	.70.....	.889
.21.....	.594	.71.....	.892
.22.....	.603	.72.....	.896
.23.....	.612	.73.....	.900
.24.....	.621	.74.....	.905
.25.....	.630	.75.....	.908
.26.....	.638	.76.....	.912
.27.....	.646	.77.....	.916
.28.....	.654	.78.....	.920

The most important factor that affects the speed aerodynamically is parasitic resistance. This is better termed parasitic loading. The smaller the power expended in overcoming the excess parasitic drag, the greater the H.P. available for speed. One way to account for this parasitic loading is to add it to the power loading value per square foot of area.

This is used when the formula for wing area and power is used to determine the speed. In Warner's formula this is all accounted for in the choice of the K value. Obviously high parasitic loading means a low K value and vice versa.

The formula for speed based on power loading hasn't a very substantial application in accurate figures of speed. Low power loading means a high speed. On the other hand high wing loading doesn't necessarily mean a high speed unless the power loading is proportionately low.

Merely having a heavily loaded plane doesn't mean a high speed in any sense unless the power loading is low, the P/S ratio high, and the design very clean. The importance of wing loading cannot be overlooked in using Diehl's formula. The basis of that formula is stalling speed.

The value of the P/S ratio is the most vital factor in the estimation of speed. It is the value of the H.P. per square foot of wing area. The greater the P/S ratio the higher the speed. For extreme accuracy propeller efficiency should be introduced here. As an example in using this factor, take the Northrop Gamma.

The P/S ratio is 2.09. By referring to Table II it is seen at once that the speed is 221 miles per hour at that P/S ratio. This applies to the calculation of the speed for any plane and is usually correct to within 5 miles per hour.

In estimating the speed for a check some comparison should be made to existing known design performances. The various factors such as the total drag, the power, the P/S ratio should be compared. In this way a very close assumption can be made provided of course the cleanliness is also considered.

In using the N.A.C.A. formula the drag loading per square foot is necessary to be known. This may be determined from the formula for total drag.

Drag Total:

$$\frac{375 \times Nm \times HP}{\text{MAX. HORIZONTAL VELOCITY}}$$

Drag is in pounds.

Nm: Propeller efficiency at maximum.

H.P.: Horsepower.

The Velocity is figured in miles per hour.

In estimating the parasitic drag loading, figure the total drag and deduct the total drag of the wing. This gives the parasitic drag. Take this quantity and divide it into the wing area for the parasitic drag loading.

To the casual student of aerodynamics the problem of estimating the high speed seems very complex. However the above formulas are very simple. With a little study there is no reason why speed estimation should baffle the tyro aerodynamist.

END

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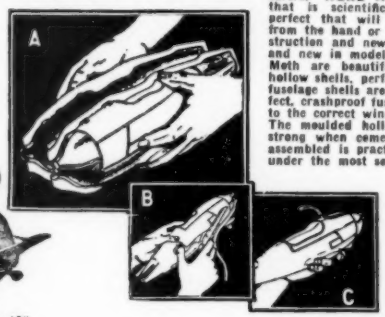

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RAS

Gordon-Bennett

(*Continued from page 24*)

in this country to be fitted with a completely retracting landing gear. The landing gear was retracted by means of a crank and the same mechanism automatically flattened the wing, giving it a variable camber. This was of great advantage in aiding the craft to a quick take off and at the same time it could be used to retard the landing speed.

It was estimated that the use of this variable camber wing boosted the speed of the craft at least 200 m.p.h. This ship was built with a full cantilever wing and a monocoque fuselage.

It was covered with three-ply veneer. Fitted with a 250 h.p. Hall-Scott, it was able to do slightly better than 200 m.p.h. in its test flights. This machine was designed by Milton Baumann and it was piloted by Howard Rinehart, chief test pilot for the Dayton-Wright organization.

For the 1920 race, England entered a Sopwith biplane, a Nieuport "Goshawk," and a Martinsyde "Semi-quaver." The Martinsyde was the most outstanding of these three craft and it was simply a small edition of the Martinsyde-Scout of wartime fame.

The French entered a Spad and several Nieuports. The Spad was a standard "20" model with the gap greatly reduced and with a streamlined cover over the observer's cockpit. The Nieuports were a development of the Nieuport 29 C1 which would have been adopted as the standard French pursuit had the war continued. The racing editions of these craft were much smaller than the standard models and they were fitted with but a single set of struts.

Just before this race was called, Rohlfs brought his Curtiss in for a rough landing. He cracked the ship and injured himself rather badly. The English had a streak of rotten luck and it looked like the race would be a run-off between the United States and France alone. However, the trick landing gear-wing mechanism of the Dayton-Wright failed to work properly and it was eliminated. Then, the Army entry took it on the chin when its Packard engine began prefiring so badly that the ship was forced down.

The French were thus able to take things easy and the contest turned into a private affair among the Nieuport pilots and the Spad man. When it was all over the Spad had won, covering the 186.45 mile course in slightly under one hour and six minutes, and the Gordon Bennett became the permanent possession of France.

It is interesting to note, incidentally, that in spite of all the publicity they are given, the majority of our *modern* racing planes are *not* able to equal the average speed of that 1920 Spad.

END

Aeroneer

(*Continued from page 29*)

The general structure of the fuselage is of the type used by the Northrop and Douglas Companies in most of their commercial and military models. The stiffener sections themselves are exactly those used by the Northrop Company and are made from their dies of 24 ST Aluminum Alloy. The cover of the fuselage is Alclad 24 ST Aluminum Alloy.

The wing is divided into five separate parts. The tips are fastened to the outer wing panel by means of bolts and elastic stop nuts and the outer wing panels are attached to the center-section by means of standard Northrop attaching angles and bolts. The tip structure is composed of skin and span-wise formers which fasten to the rib located at the tip of the outer wing panel proper.

The outer wing panel proper is of stiffened skin construction using Northrop standard stiffeners as load-carrying components combined with a beam designed to take the total shear due to the wing loads, and having heavy Northrop sections as beam caps. This beam is designed as a shear field beam with vertical stiffeners as supporting members, according to Wagner's Analysis on thin sheet beams.

This beam is located at the 30 percent point of the chord every place along the span of the wing, and its center line is perfectly straight from wing tip to wing tip, and perpendicular to the plane of symmetry of the airplane, thus obviating any eccentric loads to the loading of this spar.

At the 65 percent point of the chord every place along the wing is a shear carrying member to close off the torsion box formed by the skin covering of the wing section. This general method of construction has been found to give very low torsional deflections, especially by the Northrop and Douglas Companies in their commercial and military airplanes. The stiffened skin structure is also of the general type used by the Northrop and Douglas Companies and the single spar design to carry the total shear is in use by the Lockheed Company, notably in their "Electra" transport model commercial airplane.

The aileron is of Alclad 24 ST basic structure and is fabric covered. This type of control unit is used by the Douglas, Northrop, Boeing, Hughes Aircraft Companies on all of their recent airplanes. The aileron is hinged from the wing by means of a piano hinge on the top surface extending the full length of the aileron in a manner which has been used by the Lockheed Company.

The flap, at the rear and on the lower surface of the outer wing panel, is suspended from the outer wing panel.

END

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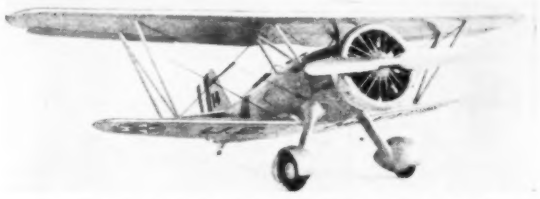

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Above photo shows finest equipped model of this plane on the market. Having ready made motor, cowl, prop, etc., it is very easy to build and is a beauty. Const. set contains 2" celluloid motor, 3¼" spun tapered aluminum cowl ring, 8" steel type paulownia wood prop. 1⅝" celluloid wheels, tail wheel, insignia, windshield, instrument board, 1 oz. yellow dope, 1 oz. blue, cement, glue, all parts printed on balsa, and drawing.
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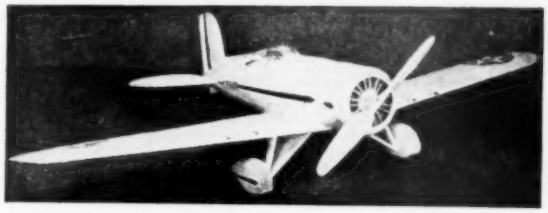

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32" Span. Length 20½". Weight 3½ oz. ¾" Scale

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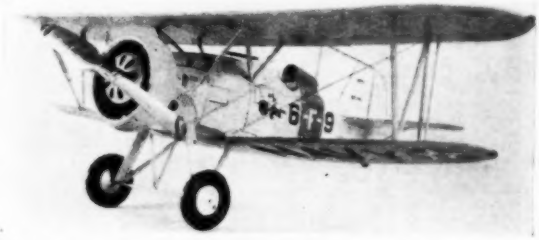

22½" Span. Length 14½". Weight 2½ oz. Color, Grey, etc.

This is the finest equipped Boeing, F4B4 model in the world. New improved model exclusively equipped with new 3¼" special aluminum streamline tapered cowl ring, 9 cylinder celluloid motor with aluminum ventilator front, 8" carved varnished steel type propeller, printed out balsa wood parts, 2 oz. grey dope, ⅛ oz. yellow, ⅛ oz. red, paper cement, glue, formed wire parts, celluloid wheels, tail wheel, U. S. Navy lettering, colored insignia, and ¾" scale drawing. **Construction Set complete, postpaid** **$2.95**

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A beautiful flying model of the latest Northrop 280 m.p.h. fighter. Set contains 3" turned motor front, 8" carved propeller, insignia, silver, black and clear dope, glue, all parts printed on balsa, full scale drawing, and all parts to build as shown.
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LOCKHEED R20-1 NAVY ATTACK

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Spin Tunnel

(Continued from page 34)

work out designs for airplanes which will not possess dangerous spinning characteristics, by means of this tunnel.

In addition to the Langley Field tunnel, there is only one other vertical tunnel in existence. The latter was installed some time ago at Farnborough, England, and is the property of the British Royal Aircraft Establishment.

So far, the N. A. C. A. tunnel has been used chiefly with models of airplanes of known performance to test the reliability of the tunnel's results. However, it was announced at the conference that the Navy's Bureau of Aeronautics will use the new tunnel for tests of models of the Grumman Fighter.

Lee Gehlback, noted test-pilot, who narrowly escaped with his life when a new military airplane went into a spin which he could not break, remarked as follows on the "free-spinning" wind-tunnel: "That's what I call real progress. It's a whole lot better to sit here in the laboratory and watch the progress of a spin than to have to watch from beneath a parachute an airplane which you have had to leave spinning down over your head, with the ground rushing up at you, while you wonder whether the airplane is going to land on you."

In order to better determine the effects of the various manipulations of the controls (which are, as stated before, operated automatically) motion pictures will be made at close range of the plane as it is launched into a spinning attitude in the jet of air.

There have been many mathematical formulae devised for computing spin reactions and centrifugal stresses set up by them but it remains to be seen whether these equations are in keeping with the results obtained in the spin tunnel.

END

Wings

(Continued from page 30)

ratio of 7 was used, we would have to correct for lift and drag. Correcting for C_L, ($C_L \times$ Factor) = (1.56 × 1.03) = 1.6.

The wing area would be 230.9 sq. ft. for the same landing speed. The span

---

is found as, $\sqrt{}$ A.R. × Wing area. In this case the span would be

---

$\sqrt{7 \times 230.9}$ sq. ft. = 40.2 ft.

Since the wing area is decreased and the induced drag is also, this aspect ratio is much more desirable. The reduction in induced drag is more important than the increase in span.

The following may be said concerning the lift:

(1) The burble-point occurs at a smaller angle of attack as the A.R. is increased.

(2) The $C_{L_{max.}}$ is slightly increased as the A.R. is increased.

(3) The rate of change of lift with a change in the angle of attack, is greater for the higher aspect ratios; an important point in the design of a tail.

The lift to drag ratio is not seriously affected by a change in aspect ratio which means that, for airplanes in which high speed is the only requirement, the A.R. of the wings might be any desirable value. This is noted in the case of racing planes where a low A.R. is desired because of the greater strength.

If a biplane is designed to be as efficient as a monoplane, both of the same airfoil section, an aspect ratio of 10 will have to be used on the biplane. This is for a gap/chord ratio of 1.0. An aspect ratio of not lower than 7 should be used. By choosing a more efficient wing section, even better results can be obtained.

END

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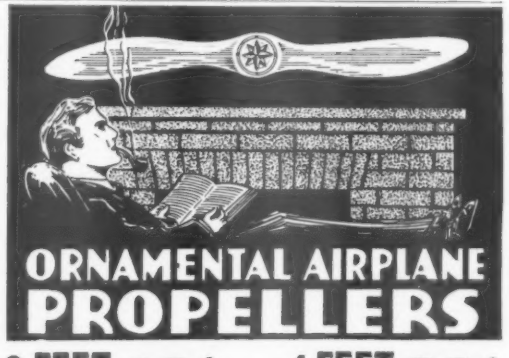

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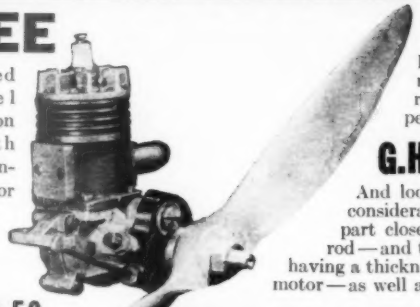

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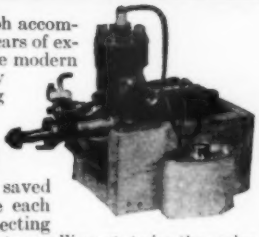

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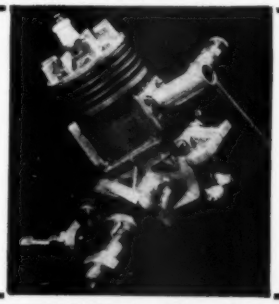

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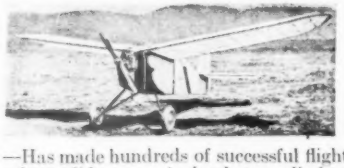

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Rockets

(*Continued from page 28*)

A few years later one John Wilkins of England, a young man who later also would be a bishop, relied on the work of his predecessor to a certain extent. But twenty miles up, John figured, all weight ceased. "If a man were above the sphere of this magnetic virtue which proceeds from the earth," he wrote, "he might stand there as firmly in the open as he can now on the ground and he might also move about with greater swiftness than any living creature below."

So, in 1640, in his story "The Discovery of a New World," John Wilkins went a step farther than Bishop Godwin. He would use the good Bishop's "swans of the East Indies" to take his chariot up twenty miles; and then he would halt the birds and walk out on the air and go wherever he liked. This upper air, according to John, was thin, like mountain air and in breathing it a man should use a wet handkerchief pressed to his nose. For food he could live on "smells and odors."

About this same time a French writer came nearer the truth.

It has been my observation in examining patents and in studying the history of invention that when one goes back to the earliest beginnings of a practical invention he usually finds there a Frenchman or two. The Englishman and the German, and the Scandinavian, and the American, and the other industrial nationals come later and perfect the idea—make it work; but the Frenchman usually had the basic, undeveloped idea in the first place.

The famous Frenchman, Cyrano de Bergerac, wrote his *Voyages to the Moon and the Sun* about 1640. Cyrano's hero was inclined to experiment. He first fashioned a belt that would hold bottles of water, with the idea that the sun would change the water into dew and draw him up. The apparatus worked to a certain height, but there let the hero down. Now the hero decided that the thing to use was a crate *propelled by successively exploding rockets.* A rocket space ship of the imagination, more than three centuries ahead of the first practical craft of the same type!

More than two centuries later, in 1866, Jules Verne, another highly imaginative Frenchman, wrote in "From the Earth to the Moon" of a moon ship fired from the earth by a space gun, something like the space gun recently shown in H. G. Wells' picture "Things to Come." This type of gun at present would not work in theory as it would fire the ship through the atmosphere so fast that friction would burn it up. But Verne also suggested the use of rockets to brake the fall of the ship.

Many decades before this, however—in 1784—one Gérard imagined an aircraft which would be propelled by rockets, and which would hover at a given height by means of wings that were flapped by a gunpowder engine.

And in 1852 James Nye of Great Britain suggested the use of rockets for propelling a balloon filled with non-inflammable gas. The balloon was to be 337 feet long, and filled with hot air, and every seven seconds a three-pound rocket was to be fired.

In 1854 the Earl of Aldborough was granted British patent No. 1776 for grooves or vanes inside or outside a sky rocket to give it rotary, stabilizing motion.

In 1866 J. J. Walbach of Baltimore, Maryland, received U. S. patent 59,487 for a skyrocket which was stablized during flight by the automatic movement of a weight toward the rear; as the explosive burned and to lighten the load the ejected gases moved the weight proportionately.

In 1867 Telescheff Nicolas was granted an Italian patent for a rocket-driven airplane, the earliest patented rocket-driven craft of the air.

In 1904 Wilhelm Unge of Sweden received British patent 19,231 for a gas turbine at the tail of a skyrocket for rotating and stabilizing it.

The first United States patent for a rocket ship was numbered 502,168 and issued to Sumter Battey of New York City. He filed his application in 1893, with a rather artistic mechanical drawing worthy of his imagination. His apparatus, like many pioneer structures, was a dangerous one: a balloon filled with highly explosive Hydrogen gas, propelled by rockets. But the rocket motor was supported at some distance from the rear of the gas envelope.

In practice, the use of Hydrogen gas would prove to be impracticable because of the tremendous weight of the steel drum used for carrying the gas. Several projects have been advanced from time to time in which Hydrogen was to be the motive power, but all of them failed.

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3/16x½ .... .07
3/16x1 .... .08
¼x¼ ..... .02
¼x½ ..... .06
¼x1 ..... .10
5/16x5/16 .. .06
⅜x⅜ ..... .09
⅜x½ ..... .10
½x⅝ ..... .15
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⅝x⅝ ..... .15
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1/8 dia. ft. .10
3/16 dia. ft. .15
1/4 dia. ft. .20
5/16 dia. ft. .20

Aluminum Tubing
1/16 dia. ft. .08
3/32 dia. ft. .09
1/8 dia. ft. .10
3/16 dia. ft. .11
1/4 dia. ft. .12
3/8 dia. ft. .15

Sheet Aluminum
002 6"x6" .05; sq. ft. .15
005 6"x6" .07; sq. ft. .17
010 6"x6" .07; sq. ft. .20
1/32", 6"x6" .15

Rivets (Lightweight)
⅛x¼ per dz. .05

Bamboo Paper
24"x36" sheet .05

Special Jap Silk
Grade A silk per yd. .40

Model Makers Knife
each ..... .10

Model Making Pins
per 100 .05
T Pins 50 for .10

Sandpaper
No.
½..... sh..05
0..... sh..05
000..... sh..08
0000000000 sh..10

Masking Tape
¼" pr card 3'.05

Sheet Celluloid
12x16 sheet .18

Moisture-Proof Ignition Wire
Per Foot ... .05

Gas Model Wheels
Special pneumatic wheels good for gas model from 3' to 8' Size 3½". Price pair $1.50

Balsa Wheels
3" dia. ..pr. .20
1½" dia. pr. .15
1⅛" dia. pr. .10

Hardwood Wheels
3" dia. ..pr. .12
1⅞" dia. pr.4.08

Washers
⅛, ¼, ⅜, ½, ¾ dia. doz.
Any size. .10

Birch Dowels
36" lengths
⅛" dia.... .03
3/16 dia.... .04
1/4 dia.... .05

IMPORTANT ORDERING INSTRUCTIONS
ADD 15c to every order under $1.50. Add 10% to all orders over $1.50. Add 25c extra to all orders for 5 foot lengths. These charges are for packing and postage. All orders packed in non-breakable cardboard tubes which insure safe delivery.
Complete Gas Model Catalog on Request

HEATHE MODEL AIRPLANES
438 East 98th St., Dept. 2A
Brooklyn, - - New York

set off by the pellet as it fell in the cup and closed a circuit.

The second U. S. patent on rocket ships was issued to Edwin Pynchon of Chicago, on an application filed November 1893. Pynchon called his ship the *Albatross*. He had a promenade deck, a captain's deck, passenger compartments, water tanks, a large bumper or "camel" of compressed air at the bow, and many other nautical appliances. He proposed to use a buoyant gas for ascending some distance, then to begin firing rockets.

He would control the amount of buoyancy of the craft by the increase or decrease of the percentage of air in the light gas. The craft, like Ney's earlier balloon, was intended for use in the earth's atmosphere.

Several years ago, the writer had an idea along this line which like most untested ideas most likely would not prove feasible. This was to use a rigid, streamlined, duralumin balloon, pointed in an upward instead of a horizontal direction to lift a rocket motor to the stratosphere, and then in this region of little friction to utilize the rocket motor, located in the tail of the balloon, to propel the craft on into airless space.

The rocket motor might be set to begin exploding automatically at a certain height —as by use of clockwork, or a temperature or altitude sensitive device. When the rocket fuel was expended the craft would sink by gravity to the earth's atmosphere, where another automatic device would open a valve to allow enough of the buoyant gas to escape to cause the craft to settle gently to earth. Or the gas valve could be automatically opened for a period after the discharge of the last of the fuel from the tanks.

If this idea is of any value to the experimenters working in this very pioneer field they are welcome to make use of it. It does seem to the writer that it might have the merit of being one *cheap*, immediate way of sending an instrument-bearing rocket into outer space, whatever its ultimate advantages might be.

In 1903 M. Wiberg of Stockholm, Sweden, filed application for his Swedish patent No. 17,987 for a rocket-driven aircraft. In the same year, A. Maul of Dresden, Germany, filed application for his U. S. patent No. 847,198 for a parachute used with a rocket for landing cameras and other scientific instruments.

In 1909 C. Antoonovich of St. Petersburg (later Leningrad), Russia, filed application for his German patent No. 228,654 for a like craft.

In 1910, H. H. Bales of British Columbia, Canada, filed application for his U. S. patent No. 1,003,411, showing an airplane with an ordinary engine used to turn an ordinary propeller, with rockets below and to the rear of the center of gravity for use if the engine fails.

In 1910 N. Gherassim of St. Petersburg (later Leningrad), Russia, filed application for his U. S. patent for a rocket stabilized by a gyroscope.

A Belgian patent was granted to Dr. Andre Bing in 1911 for a rocket-driven space ship.

Thus, during the last half of the Nineteenth and the first decade of the Twentieth Century, the rocket air and space ship—at first nebulous in the mind of man—began to take definite form.

Now the practical scientists and inventors and the dare-devil pilots of the extremely dangerous early rocket crafts on earth, ice and in the air began to play their part in the development of this ship of the stratosphere of the near future and of interplanetary space in the ages to come.

Fittings

(*Continued from page 24*)

must be no members taking "off center loads" or no "eccentric moments" set up in wing spars or struts.

For example, we would not give thought to drilling all holes 1" from the bottom of a 5" spar for a strut-spar fitting. There would immediately be an "eccentric moment" or "off center" load set up in the wing spar. If a straight line is drawn through the absolute center of the strut and also the spar, the concentration point on the spar would be at the intersection of these two lines.

We would then drill the holes of the fitting accordingly. Proper design requires that "follow through" be awarded the strict attention of the designer and builder.

The most important wing fittings such as strut, center sections, flying wire and landing wire fittings should be made of 12 or 13 gauge cold rolled steel, while internal drag brace fittings and other similar ones may be of 16 gauge C. R. S.

When bending cold rolled steel it is done cold, don't heat a fitting. In bending cold rolled steel do not hammer the metal, unless using heavy gauge, as it will fracture the metal on the outside of the bend. This would result in probable weakness of the fitting. Such defects, in the mind of the layman seem very minor, but this alone, if very serious, would prevent the builder from maintaining the aforementioned safty factor.

END.

Anchor

(*Continued from page 22*)

toon. It is released from the pilot's cockpit and so designed that it digs into the bottom like any marine anchor.

To "up anchor", the pilot taxies slowly over the anchor, lifts it vertically, and reels it back into its nest in the nose of the pontoon. The device may be used on both pontoons of a seaplane, or on the nose of a flying boat.

END.

The FLYING FLEA

How To Build and Fly It!

COMPLETE instructions and detailed drawings for building this famous French lightplane. Authentic translation from the French of Henri Mignet, the designer. Profusely illustrated and absorbing book recommended to everyone interested in aviation. Price $3.00 postpaid. Imported from England.

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COLT 45 Cal. "FRONTIER" model kit. 5½" barrel.	1.55
COLT 45 Cal. "FRONTIER" model kit. 7" barrel.	1.70
COLT 45 Cal. Automatic Pistol kit.	1.00
Half scale Thompson Sub Machine Gun model kit.	1.00
Full scale Thompson Sub Machine Gun model kit.	3.00
SAVAGE Cal. 32 Auto. Pistol kit, machined barrel.	.75
LUGER Auto. Pistol with 4" machined barrel.	1.75
LUGER Auto. Pistol with 6" machined barrel.	1.90
COLT 25 Cal. Automatic Pistol kit.	.50

These beautiful kits are complete in every detail and made of the best basswood. All parts are cut to shape and require only a short time to finish. Postpaid in U. S. A.

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18" Balsa Sheets		**18" BALSA STRIPS**		**Colored Dope**		**Balsa Balloon Wheels**	
1/32x2	5 for 5c	1/16x1/16	125 for 5c	1 oz.	5c	½", 2 pair	3c
1/16x2	5 for 5c	1/16x⅛	50 for 5c	½ pt.	30c	¾", pair	2c
3/32x2	4 for 5c	⅛x⅛	30 for 5c	**Clear Cement**		1", pair	3c
⅛x2	4 for 5c	1/16x3/16	25 for 5c	1 oz.	5c	1½", pair	5c
3/16x2	3 for 5c	1/16x¼	20 for 5c	½ pt.	25c	2", pair	8c
¼x2	2 for 5c	3/32x3/32	40 for 5c	1 pt.	45c	3", pair	14c
½x2	1 for 5c	⅛x¼	12 for 5c	**Wood Veneer**		**PROP. SHAFTS**	
For 3" Sheets, double above prices.		¼x¼	10 for 5c	20x30", 1 for	9c	2 for	1c
BALSA PROP BLOCKS		¼x½	5 for 5c	2 for	17c	**PAUL-O-WINA JAP PROPS**	
¼x¾x6	6 for 5c	½x½	4 for 5c	**Reed**		5"	10c
½x¾x5	7 for 5c	**18" BALSA PLANKS**		1/32, 1/16"	3 ft. 1c	(Add 5c per inch for props up to 10".)	
⅜x1x8	3 for 5c	1x1, 1 for	4c	½", 3 for	2c	**Machine Props**	
¾x1x8	3 for 5c	1x2, 1 for	9c	**Wooden Wheels**		5"	4c
¾x1¼x12	2 for 6c	2x2, 1 for	15c	½", 2 pair	3c	(Add 1c per inch for props up to 16".)	
1x1½x12	1 for 6c	2x3, 1 for	19c	¾", pair	2c	**Rubber Motors**	
1x1½x15	1 for 7c	2x6, 1 for	35c	1", pair	4c	1/16 sq. 20 ft.	5c
For 36" lengths double above prices and add 10c postage				1½", pair	4c	⅛ flat..20 ft.	5c
15" BAMBOO	6 for 5c	**Tissue..** 5c	6x8	4c	1¾", pair	7c	**Model Pins,**
1/16x½..6 for 5c	**Doz.**	.50c	12x16	15c	**Celluloid Wheels**		pkg. 5c
Shredded..40. 5c	**Thinner Best**		**Clear Dope**		¾", pair	5c	**Brushes No. 6** 5c
Japanese Tissue	1 oz.	5c			1", pair	7c	**Sandpaper,**
All colors, Dz. 16c	**Sheet Celluloid**		1 oz.	5c	1½", pair	9c	pkg. 5c
Silver or Super-	2x6	2c	½ pt.	25c	1⅞", pair	15c	**Thrust Bearings** 1c
ALUM. LEAF,	**36" lengths,**		**small**	.5c doz.	doz.	1c	**Bushings, doz.** 3c
2 sheets for 1c	**NOSE PLUGS,**		**Miscellaneous**				
WIRE, 6 ft. 3c	large..10c doz.		**Washers,** ¼, ⅛				

INSIGNIAS—French, American, English, German 1½" .... 4 for 3c; 2" .... 1c; 1 sheet of 24, 5c

Dummy Radial Engines 1½" Diam..14c; 2" Diam..18c; 3" Diam..23c

DOWELS, 1/6x12 10c per doz.

SPOT WELDED HOLLOW ALUMINUM WHEELS 1" .... pr. 6c; 1⅜" .... pr. 11c; 1⅞" .... pr. 14c

Sheet Aluminum .003 .... sq. ft. 10c

Alum. Tubing 1/16", 3/16", ¼" .... 10c ft.

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SKYWAY MODEL AIRCRAFT SUPPLY CO. 383 Seventh Ave., Dept. P, Brooklyn, N. Y.

Lindberg

(Continued from page 47)

over tall grass to see whether it is properly balanced. If model glides a short distance and nose rises abruptly, it will be necessary to add weight to bottom of nose block. If model dives, add weight to tail. After the model is balanced to glide at an even angle, you are ready to test your model under power.

In making the test flight, the principal thing to avoid is damage to your model. Gliding and flying it over tall weeds is the safest, because the weeds or tall grass break the fall gently in case that the model should stall or dive.

A few trial flights will acquaint you with the ship.

END

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CENSUS

Sales Models

(Continued from page 44)

little motors so they would work when the props were turned. Naturally you could not see them move from the outside, and what was worse, he had to leave two cylinders out of each motor to get the pistons large enough to work on, thus the plane was not a scale model, and its value was lessened considerably. That was too much detail.

Another thing is important. When building a scale model, be sure to make it accurate. One young fellow made a scale model of a Lockheed Sirius in solid wood, for a pilot. Through some accident the cockpit was placed too far forward. Naturally the plane could not be sold as a scale model.

Most boys will find one field of model selling the most lucrative. Don't try to cover the whole field alone. Stick to one branch unless you get an order for a different type. My best branch was the fifty to seventy-five cent range of flying models. You will find a dozen people to pay fifty cents, for every one who will pay three dollars.

For a half dollar you can sell a neat twelve or fifteen inch semi-scale model, covered attractively with colored tissue and neat enough to use for an ornament. For almost two years I had spending money through the sale of this type of plane. That is the type for most young men to concentrate on.

Watch your covering jobs. A well constructed plane with a poor covering brings a very low price. A good covering hides faults in workmanship. Use attractive tissue. White trimmed with blue is good for Lockheeds. Yellow and blue are popular. Aluminum and black, red, or blue look nice. Color scale models like the real ships if they have a distinctive color scheme. Above all, don't make them gaudy.

Try to make the different parts of the ships in good proportion to each other. The landing gears and propellers of most small models are much too large. Cutting their size reduces flying qualities, but enhances the appearance. The plane is sold by its appearance. The people who appreciate good flying qualities make their own planes.

Now suppose you are ready to sell some models. You must get them before the public. If you have a friend or relative who has a place of business, perhaps you could put a few in one of the show windows or cases. If that is not possible, try a drug store. They handle about everything else anyway. If there is a model airplane supply store in your town, put a few in it.

They will usually let you exhibit some if you buy your supplies there. If there is an airport near your home, ask the pilots if they would like to buy a model of their plane. They are often good customers. If an aviation movie comes to town, try to rent a few planes to the theatre for exhibits, or put some in the lobby—hung out of people's reach—in return for the advertisement it gives you. You have a good chance to sell models to ticket agencies for airlines. When you get contacts with big companies like the airlines, there is a chance to get a job in their factories.

FIVE DON'TS FOR MAKING MODELS TO SELL

1. Don't misrepresent your planes. If they won't fly, don't call them flying models.
2. Don't skimp too much. Poor construction never made money consistently. Be economical, but don't sacrifice quality.
3. Don't try to do too much at once. If you hurry too much, the planes will suffer.
4. Don't treat the customer as a simpleton because he doesn't know how to fly the plane. Show him how it is done.
5. Don't bring out new ships too late. Start drawing plans when the new ship is just beginning to become popular. Put your models on the market when the real ship is at the peak of its popularity.

FIVE DO'S IN MAKING SALES MODELS

1. Design your own types when trade is slack. Sell "exclusive" designs.
2. Put additional touches of your own on models that don't seem attractive. Pants on the wheels help.
3. Get into contests. If you win you have a good advertisement for your planes.
4. Make planes that can be easily constructed. It saves time and money.
5. Make them resemble real planes.

END

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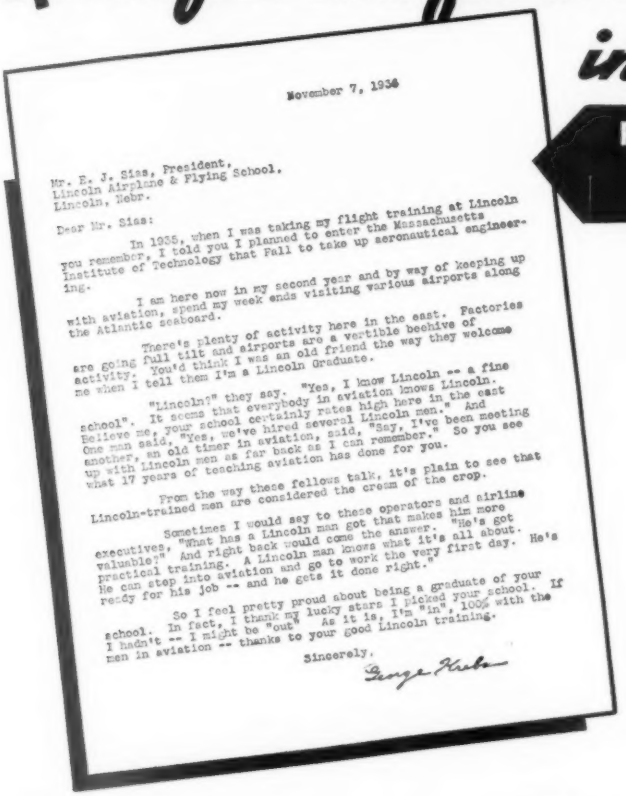

November 7, 1936

Mr. E. J. Sias, President,
Lincoln Airplane & Flying School,
Lincoln, Nebr.

Dear Mr. Sias:

In 1935, when I was taking my flight training at Lincoln you remember, I told you I planned to enter the Massachusetts Institute of Technology that Fall to take up aeronautical engineering.

I am here now in my second year and by way of keeping up with aviation, spend my week ends visiting various airports along the Atlantic seaboard.

There's plenty of activity here in the east. Factories are going full tilt and airports are a veritable beehive of activity. You'd think I was an old friend the way they welcome me when I tell them I'm a Lincoln Graduate.

"Lincoln?" they say. "Yes, I know Lincoln -- a fine school". It seems that everybody in aviation knows Lincoln. Believe me, your school certainly rates high here in the east. One man said, "Yes, we've hired several Lincoln men." And another, an old timer in aviation, said, "Say, I've been meeting up with Lincoln men as far back as I can remember." So you see what 17 years of teaching aviation has done for you.

From the way these fellows talk, it's plain to see that Lincoln-trained men are considered the cream of the crop.

Sometimes I would say to these operators and airline executives, "What has a Lincoln man got that makes him more valuable?" And right back would come the answer. "He's got practical training. A Lincoln man knows what the very first day. He can step into aviation and go to work what it's all about. ready for his job -- and he gets it done right."

So I feel pretty proud about being a graduate of your school. In fact, I thank my lucky stars I picked your school. I hadn't -- I might be "out". As it is, I'm "in", 100% with the men in aviation -- thanks to your good Lincoln training.

Sincerely,

George Krebs

READ THIS LETTER FROM ONE WHO HAS TRAINED AT THIS GOVERNMENT APPROVED SCHOOL

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George Krebs found out what the industry thinks of a Lincoln man. "You'd think I was an old friend," he says, "the way they welcome me when I tell them I'm a Lincoln Graduate."

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"Give us a Lincoln man," they say. "We KNOW he's ready for his job. We haven't time to complete the training of half-trained men." Why is the Lincoln man preferred? Because he's had practical training. When you finish at Lincoln you KNOW **what** to do and HOW to do it. You've done it.

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Remember, 26 years success as a mechanics trade school and 16 years successfully teaching aviation give Lincoln first place in experience among civilian schools teaching aviation.

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Model Engines

(*Continued from page 46*)

crankcase, with a cast iron piston and cylinder, while the head is of cast aluminum. All parts are extremely well made and it is the claim of its builders that the working parts are ground to a finer fit than those of any other motor on the market. It comes complete, postpaid, for $21.50.

The above type motors, excepting the Baby Cyclone, come with an adjustable spark which permits a wider range of speed and reverse of rotation. They all work on from 3 to 5 volts, which are supplied by two or three flashlight size dry cells.

The two extremes in model gas motors are the Elf and Forster Brothers' Motor. The Elf is of about 10/16 inch bore and stroke and develops .035 horsepower at 4700 r.p.m. The cylinder and crankcase are sand cast of aluminum; the cylinder is fitted with a steel liner and the aluminum piston is fitted with two rings, on the skirt and one ring at the head.

This small motor can be used in a plane of 2 to 5 foot wing spread, which in the author's opinion is just the right size, as the model can be carried in the car and still leave room for a few people, and more work can be put into the model for much less than with the present gas models.

This small motor costs $21.50 which, although it sounds expensive, is very cheap in comparison with the other motors, as the limits to which the parts are fitted is about ¼ that of the larger types. Unlike the other motors, the Elf is supplied with a propeller and two small pen type flashlight cells.

The Forster Brothers' Motor is the largest motor made for use in model airplanes. It has a bore and stroke of 1⅛ inches and also is of aluminum with a steel liner and piston rings. This motor sells for $17.50 ready to run, $12 for finished parts and $5.50 for rough castings.

No matter what motor is finally purchased, the time will come when, new and shiny, it is set on a box or bench and preparations are made for the first test run. After reading the instructions sent with the motor carefully, the batteries should be wired in series and all wires should be firmly soldered. Then the prop should be bolted to the shaft in the recommended position; then, with switch off, the prop should be flipped over several times with the choke closed; then, with switch on, the prop should be flipped with a wrist-like motion.

The motor should pop or start after a few flips; if not, repeat entire procedure. If after several tries the motor does not start, the wiring should be checked and spark should be tested. Remember, nothing can go wrong inside and the motor was tested before it was sent to you.

If the motor pops with each flip but does not run with needle valve in recommended position, the motor should be turned up so that air or venturi tube is vertical with ground; then it should be turned over several times to clear the crankcase of the surplus gas which has flooded the motor.

If after two or three days' trying with a change of batteries no results are forthcoming, the motor should be sent back to the factory with a detailed letter covering the exact trouble, i.e., refuses to start, cuts out, etc.

Above all, do not take your motor apart until you know what you are doing and do not send it to any of the so-called motor experts who advertise a complete overhaul for a dollar or some other very minor charge. If your motor is new and you have any trouble the factory will service it free, as they all guarantee their motors to run.

The gas should be of the straight type and should be mixed with a heavy oil of at least 50 S.A.E. viscosity. It should be well mixed and run through a fine wire mesh or cloth strainer before pouring into the gas tank.

After installing in a model the motor usually runs for about six weeks before giving trouble; then it just won't start at a crucial time. First test your spark by turning the prop over to see if the points are working. If they are, take the plug out and try spark again and make sure that you are getting a good hot spark with every flip. If this doesn't work, try motor to see if it is flooded, clean all points, plug and outside of plug. This usually brings results.

When after a bad crash or several years of running your motor needs to be repaired, it should be sent back to the factory. They have invested several hundred dollars in the machinery necessary for regrinding your cylinder alone and in the long run it will be much cheaper to have them rebuild your motor into one as good as new.

With some care the model gas motor should last for two or three years—in fact, the motor owned by the author is still running after three and a half years of running and the motor used by Bassett in almost all of his prize winning flights is now starting its fourth year.

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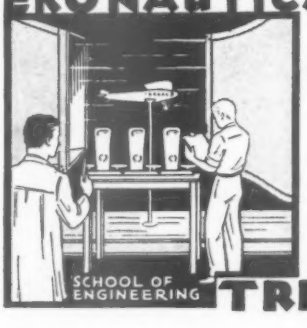

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2-Row Engines

(Continued from page 26)

single-row engines. The engines differ, therefore, only in the essential features of the two types and comparison of their service records should provide a reliable indication of their relative advantages or disadvantages.

It might be expected that an engine with two crank throws, two rows of cylinders, and other corresponding parts in duplicate would be appreciably heavier than a single-row engine, yet the Twin Wasp Junior in pounds per cruising horsepower is less than 10 per cent heavier than the Hornet engine of substantially equal power.

In common with internal combustion engines in other fields, the two-row radial aircraft engine exemplifies the improvements in operating characteristics which follow from an increase in the number of cylinders. One of these operating improvements is in general smoothness and freedom from vibration. Thus with the two-row engine the effects of repeated stresses on the airplane structure are minimized.

The fact that, as compared with the single-row engine, the two-row has more and smaller cylinders results in a second important advantage—that of a reduction in the stresses in the propeller that are produced by the explosion impulses. The result is that for a given engine power and propeller speed the weight of the propeller for the two-row engine may safely be less than that for the single-row engine.

Service experience has clearly supported the belief that the two-row engine is less noisy than the single-row engine of equal power, due partly to the smaller cylinders, with resulting decreases in the energy of the individual exhaust impulses, and partly to the higher frequency of the exhaust pulsations which make the noise less objectionable in character.

It is inevitable that in equal power and in equal production quantities the two-row engine must be more expensive to manufacture than the single-row type, simply because it contains more parts and consequently involves more labor. The ratio of costs, however, is considerably less than the ratio of the number of cylinders and in fact even in present production quantities the ratio of selling prices is well below that ratio.

Here, however, it should be mentioned that the use of smaller cylinders and the smooth-running characteristics of the two-row engine warrant the expectation both of a longer total life and of longer intervals between overhauls than in the case of the single-row engine, thus to some extent offsetting the differences in first cost and in the cost of individual overhauls.

When the development of large two-row engines was first undertaken, it was feared that it might prove very difficult to cool the rear cylinders adequately. Fortunately, however, the contemporaneous development of the close or pressure-type of baffle so reduced the quantity of air required for cooling that it has become relatively easy to insure to the rear cylinders an adequate flow of air that has not been heated by contact with the front cylinders.

Another recent development in engine cooling, the controllable cowl, has made it possible to obtain an adequate total flow of air, even under difficult conditions, such as in climb, and at the same time to reduce both the air flow and the resulting drag under the easier cooling conditions of cruising.

The dimensional relations between the cylinders of single-row and those of the two-row engines tend toward inherently better cooling characteristics for the latter, since in relation to heat to be dissipated more cooling surface is available in the smaller cylinders than in the larger ones. Therefore, in actual service with equally up-to-date cooling equipment, the two-row engines involve no greater cooling difficulty than the single-row type.

Although overall length of the two-row engine is somewhat greater than that of the corresponding single-row, this disadvantage is offset by a reduction in overall engine diameter, which, in a typical case, amounts to about 20 per cent; this corresponds to a reduction in frontal area of about 35 per cent.

Several favorable characteristics of the two-row engine are due to this small overall diameter. One of the most apparent of these is the improvement in visibility, especially in single-engine machines.

Another consequence of the smaller diameter of the two-row engine is a reduction in drag, and, thanks to the improvements already mentioned in cowls and baffles, this improvement in engine drag characteristics does not have to be bought at a sacrifice in cooling characteristics.

Visual range, important as it is in scheduled airline operation, is infinitely of more importance in military aviation, and therefore the two-row engine is a great assistance to our navy and army.

The effect of the reduction in engine drag on airplane performance naturally depends on the design of the airplane; it is greatest in fast machines of clean design, especially those with small fuselages or nacelles.

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